FINAL REPORT OF GDA PROJECTS

144.201 AND 144.202-

MANAGEMENT OF WATERCOURSE BUFFER ZONES

APRIL 1984

NATURAL RESOURCES
NEW BRUNSWICK
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Government
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Regional
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Gouvernement
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84- 4003 /

DEPARTMENT OF NATURAL RESOURCES

FOREST UTILIZATION BRANCH

AND

FISH AND WILDLIFE BRANCH

HON. G. S. MERRITHEW

MINISTER

FINAL REPORT OF G.D.A. PROJECTS 144.201 AND 144.202 - MANAGEMENT OF WATERCOURSE BUFFER ZONES

Department of Natural Resources
New Brunswick

"This is a Federal-Provincial Development Project, funded under the Forestry Subsidiary Agreement of the Canada - New Brunswick General Development Agreement by the Government of New Brunswick and the Department of Regional Economic Expansion."

Copies available by contacting:

Forest Utilization Branch
or
Fish and Wildlife Branch
Department of Natural Resources
P. O. Box 6000, Fredericton, N.B.
E3B 5H1

Authors: Gary C. Moore
Stephen G. Henley

Catalogue No.:
ISBN 0-88838-785-7

ABSTRACT

A summary of the experimental watercourse buffer zone harvesting operations conducted during the past season, as well as overall participation and success, is presented. A discussion of the background to this project is also included.

Participation by Licensees was less than anticipated. Only in Forest Region 2 could this be regarded as adequate; the wider buffer zones in this Region undoubtedly contributed to this success. Experimental operations generally showed that removal of wood from buffer zones could be carried out in an economical and "safe" manner, at least from the standpoint of preservation of water quality. Long-term effects, however, were largely speculative and would be influenced by surrounding land usage. It was also possible to identify factors critical to the successful completion of such operations.

A production and cost analysis of experimental buffer zone harvesting operations was conducted on seven different sites and a small-scale system for selective cutting was also evaluated. The degree to which stand and terrain conditions were responsible for production changes in buffer zones was examined. Study methods, site and systems descriptions, and results of this study were presented.

Recommendations for improvement of buffer zone management were made.

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PART I

EXPERIMENTAL TIMBER HARVESTING OPERATIONS WITHIN WATERCOURSE BUFFER ZONES

GARY MOORE

INTRODUCTION

In July, 1982 a project (#144.201 under the Canada - New Brunswick Forestry Development Subsidiary Agreement) was begun to examine the feasibility of harvesting timber within watercourse buffer zones. This project was initiated by the Forest Utilization Branch and supported by the Fish and Wildlife Branch of the New Brunswick Department of Natural Resources (D.N.R.). The basic premise was that merchantable wood was being unnecessarily left in buffer zones, an opinion shared by some D.N.R. and Licensee personnel. Any additional wood volumes would help to alleviate the projected wood supply deficit forecast for this province. Conversely, watercourse buffer zones provide fisheries, wildlife and aesthetic benefits; the objective of buffer zone management must be preservation of these benefits, which may or may not include the removal of additional amounts of wood. These zones may be very valuable to wildlife as they represent one of the few avenues of long-term maintenance of mature softwood trees.

The "Interim Guidelines for Establishment and Harvesting Watercourse Buffer Strips" in the 1984 edition of the Forest Management Manual For Crown Lands suggests that minimum horizontal buffer zone widths be 15, 30 and 60 m on bank slopes of 0-5%, 6-10% and greater than 10%, respectively. It is mentioned that this guideline is primarily intended for small streams and that wider zones may be necessary on larger streams, rivers and lakes. Harvest operations may take place within these buffer zones, at the discretion of the Regional Resource Manager. This is analogous to that indicated in "Environmental Guidelines for Forest Management on New Brunswick Crown Lands", a 1981 N.B.D.N.R. publication. These earlier guidelines suggest that all streams 0.5 m and wider (normal summer flow) should have a buffer zone while there is no mention of minimum stream size in the 1984 manual.

The reference to bank slope implies that this guideline was designed largely for protection of the fisheries resource, specifically to guard against sedimentation.

It is also stated in the 1984 manual that no wheeled or tracked harvesting equipment is allowed to operate within 10 m of the edge of any watercourse. Regulations under the Clean Environment Act specify that a permit is required for any removal of trees within 10 m of the bank of a watercourse with the exception of the selective harvesting of mature or overmature timber provided harvesting vehicles are not used in this 10 m area.

An extensive literature review which attempted to encompass all aspects of watercourse buffer zone harvesting was carried out. It readily became apparent that a definitive answer regarding a "safe" amount of removal from buffer zones, or even if the minimum widths suggested were appropriate, could not be reached due to the multitude of variables involved. The value of individual buffer zones in relation to fisheries, wildlife and aesthetics will vary as will the combination of individual zone characteristics. If a particular zone is be managed only for the fisheries resource the amount of tolerable vegetation removal is more easily definable, although variation in vegetative species composition, tree quality and health and expectations for local fish populations will negate the establishment of rigid guidelines. When wildlife and aesthetic values are considered, guidelines become harder to establish; a greater overall knowledge of surrounding land use is necessary.

It was concluded that the only reasonable solution was a multidisciplined approach to buffer zone management. To this end the literature review became a description of factors and consequences to be considered by resource managers in the development of rational decisions regarding each buffer zone. To facilitate usage of this review a very brief summary, in the form of interim guidelines, was prepared; more specific information could be obtained by referring to the main text. It was hoped that this would expedite the development of uniform decision-making processes regarding buffer zones.

In an attempt to produce a more workable document a draft copy of this review was distributed to each of the Forest Regions for consideration by the Regional Resource Manager, Management Forester and Biologist(s). With a few notable exceptions the number of comments received was less than anticipated. These comments were considered and, where possible, incorporated into the final version of the literature review which was printed in April, 1983. This review was made available for public distribution and copies were forwarded to all Forest Regions and Licensees.

An appropriate follow-up to this literature review was considered to be the establishment and evaluation of numerous experimental buffer zone harvesting operations throughout the province under a variety of conditions (such as type, amount and quality of wood, type of harvest ing operation, desired or expected fish and wildlife population levels, size of watercourse, slope, soil type). The goal of this project would be to determine the economic and "environmental" feasibility of harvesting timber in buffer zones and to give resource managers an opportunity to gain experience in buffer zone management. Although the literature review portion of the project terminated at the end of March, approval for the field work was not received until the end of April. As a result, commencement of preparatory work was delayed by approximately one month.

Once approval for the project was received, Licensees were contacted and encouraged to participate. It was hoped that Licensees would be able to obtain additional wood volumes (to be regarded as bonus wood) without harming, and in some instances enhancing, the fisheries, wildlife and aesthetic benefits provided by buffer zones. As such, it was felt that any Licensee genuinely concerned about wood being left in buffer zones would want to participate. Licencees were asked to have all experimental harvesting operations completed by the end of December, 1983 so that they could be included in the final report of the project. It was made clear that there would be no subsidies for this specialized harvesting. In order for this to be a viable, long-term management endeavor any additional time and care required during the planning process and cutting operation, as well as any alteration of equipment or technique, would have to be compensated for by the value of the wood obtained or absorbed by the overall cut block operation.

The normal procedure was for the 1983 Operating Plan of each Licensee to be examined in conjunction with the Regional Biologist(s) involved and potential sites (cutting operations adjacent to watercourses) picked. These were then visited and, if deemed to be appropriate, cutting prescriptions were formulated. This formulation was largely based on the literature review and interim guidelines. It was felt that initial correspondence regarding the selection of potential sites should involve the Regional Biologist(s) due to the previously discussed values of buffer zones. Emphasis was placed on buffer zones associated with upcoming harvesting operations rather than previously established buffer zones (associated with cut blocks already harvested) as experimental buffer zone operations carried out at the same time as normal operations, utilizing the same equipment, were considered to be more economically viable. If the Licensee agreed to a particular harvest prescription, volume estimates for the buffer zone were obtained and any necessary flagging was carried out. Variation in the condition and value of each zone necessitated a variety of prescriptions. This, itself, represented a learning process whereby operators and/or foresters were made aware of environmental concerns and the reasoning for each prescription prior to the commencement of harvesting. An attempt was made to ensure that the local foreman and operators understood each prescription; this often entailed an on-site inspection with the personnel involved.

In most cases, total removal of merchantable wood from the buffer zone was not advocated due to the wildlife and aesthetic resources. Provision for aesthetics occurred largely on those watercourses frequented by recreationalists. To ensure that machinery would not enter the watercourse, an exclusion zone (no harvesting allowed) was normally established immediately adjacent to the watercourse. This exclusion zone considerably reduced the potential harm to the fisheries resource.

Following completion of each experimental harvesting operation the site was examined with the Regional Biologist involved and a subjective analysis made of both short and long-term effects on the fishery and wildlife resources. Analysis of long-term effects was necessarily vague. This approach was considered to be more practical than a more detailed study on one, or a few, watersheds due to the reported variability between and within watersheds, not only in their characteristics but also in the benefits provided by them. This also allowed a greater degree of participation. Operators were also asked for their opinions, particularly from an economic standpoint. In addition to cost and production data, any information regarding problems, derived benefits, innovative ideas or recommendations were recorded. Another project (#144.202 under the Canada-New Brunswick Forestry Development Subsidiary Agreement) was initiated to evaluate and compare productivity associated with different harvesting systems within buffer zones and normal cut blocks. The results of this project are presented in Part II of this report.

RESULTS

The following description of the experimental buffer zone harvesting operations carried out during the 1983 cutting season is subdivided first by Forest Region and then by Licensee. For the purpose of this report, "original buffer zone" width is deemed to be the width prescribed by the Forest Region prior to experimentation and "Branch" refers to the Forest Utilization Branch. All operations involving partial stand removal are termed "selective", rather than "selection", cuts because the goal of these operations is to remove merchantable trees and not really to maintain or enhance uneven-aged stand characteristics. The term "poplar" refers to balsam poplar and the aspens. "Cut block" refers to the normal harvest block adjacent to the watercourse buffer zone. All cruise information taken from operating plans applies to these harvest blocks, not buffer zones specifically. Terminology is, for the most part, non-technical in nature. A few general points will be mentioned first.

In spite of the current guidelines under the Crown Lands and Forests Act there was extreme variability between Forest Regions in the width of buffer zones. This variation was not due to local differences in site characteristics but rather in the decision-making process in each Region. There was also variation in the way the original buffer zone widths (widths specified by the Regional personnel prior to harvesting) were flagged out. This was partially due to confusion as to the exact location of the edge of a particular watercourse; distances should have been measured from the normal high water mark but this was not always the case (which often resulted in substantial differences when distances were measured from the edge of the water during low flow periods). Normal high water mark is usually well defined by an abrupt change in vegetation. In other cases it was clear that, regardless of the location of the watercourse edge, flagging was not carried out as specified. Along watercourses associated with steep slopes, flagging was normally placed at the crest of the slope.

An additional problem was the frequent removal of flagged trees. This made determination of violations following the cutting operation very difficult.

During the course of the field work obvious discrepancies in the size of stream which qualified for a buffer zone were noted as well. This appeared to be largely a function of incomplete maps and pre-cut inspections rather than a decision by the local biologist. In some cases these streams easily exceeded 0.5 m in width during normal summer flow.

The above-mentioned variability was undoubtedly a reflection of the training, background and experience of D.N.R. and Licensee personnel, as well as their overall attitude toward the value of buffer zones. Indeed, the importance of the fishery, wildlife and aesthetic resources to these people must be considered to be a factor, as well.

It is difficult to generalize about the amount of participation in a project of this nature. Although some Licensees took an active interest in this study, overall Licensee participation would have to be regarded as disappointing particularly when one considers that additional wood volumes were being offered. It was anticipated that there would be some problem in determining the exact timing of particular cutting operations but the amount of difficulty encountered in having approved cut blocks not harvested, or only partially harvested, was not envisaged. Additional problems included poor communications between head office and field staff of the Licensees, and seemingly unwarranted delays in deciding whether or not to carry out a particular prescription. Experience with some Licensees left the impression that they were not genuinely interested in this project or concerned about the predicted wood shortage. This opinion could be tempered somewhat by consideration of the economic constraints that some Licensees may have been operating under during 1983. Participation by the Regional Biologists was, for the most part, good; several of these people devoted a considerable amount of time to this project. The attitude among the Management Foresters was largely one of indifference, although there were notable exceptions.

It became apparent that experimental harvesting was generally not feasible in narrow buffer zones (particularly 15 m) due to a lack of merchantable wood and the constraints imposed by the cutting prescription.

For prescriptions involving selective harvesting it became necessary to specify that the stump measurement was to be taken at approximately 0.3 m above average ground level and, in some cases, diameter limits were increased. This was due to the harvesting of trees at, or near, root level; butt swelling would increase the likelihood of a particular tree being within the acceptable diameter limit, thereby effectively reducing the number of residual trees in the buffer zone following harvesting. Problems associated with operators inexperienced in selective harvesting were less than anticipated. Instances of unmerchantable trees being cut, supposedly to increase the harvest volume, were found.

The stipulation that unmerchantable trees and species be left during selective harvesting was questioned by some D.N.R. and Licensee personnel as having potential to lower the genetic quality of the future stand. However, in terms of protection of the fisheries and wildlife resources (which must remain as the prime function of buffer zones), this unmerchantable material may be as important as the merchantable material and may possibly be more important if it is less prone to damage from factors such as wind or insects. Such material may considerably reduce the impact of harvesting within buffer zones. Furthermore, it is questionable whether many of the defects (e.g., broken tops, forked trunks) resulting in unmerchantability are genetically related. It is generally accepted that selective cuts based strictly on diameter limit will result in some degree of high-grading as only the larger, supposedly genetically superior, merchantable trees are removed.

Layout of the road and skidtrail network was generally not specified for any of the experimental buffer zone harvesting operations but operators were asked to ensure that the potential for water ecosystem damage be minimized.

FOREST REGION 1

UPSALQUITCH LICENSE - NBIP LIMITED

No experimental buffer zone harvesting projects were carried out under this license in spite of relatively frequent correspondence with company personnel. A surplus of sawlog material made selective harvesting within these zones by the Licensee undesirable and was probably the largest holdback in establishing experimental operations. Sawlogs left standing in company blocks were removed by Sub-Licensees and this normally filled their quota. It was felt by company personnel that selective harvesting, and even strip cutting, in buffer zones would be a less practical way for Sub-Licensees to obtain their sawlogs.

Another problem, suggested by the Regional Biologist, was an apparent tentative attitude by the Licensee towards assuming additional supervisory responsibilities in light of other problems (e.g. labor) being experienced by the Licensee, particularly near commencement of operations.

Prior to initiation of this project the buffer zones of nine Licensee cut blocks were selected by the Licensee, in conjunction with the Regional Biologist, as beaver enhancement sites. These would consist of strips clearcut to the bank of the watercourse approximately 20 m in width separated by uncut strips approximately 60 m in width; the intent was that species favored by beaver as food (e.g. poplar) would regenerate in these openings. Six of the nine blocks were cancelled due to a reduction in the wood volume required and/or excessive application of cut blocks by the Licensee in its 1983 Operating Plan. Operations in one of the remaining cut blocks ceased before the buffer zone was reached, due to wet ground conditions. Operations also ceased in the other two blocks before the buffer zones were reached, due to annual wood quotas being filled. Operations in these latter two blocks are expected to continue next season.

NEPISIGUIT LICENSE - CONSOLIDATED-BATHURST INC.

The situation with this Licensee was analogous to that of NBIP Limited; a surplus of sawlogs made selective cutting undesirable unless it was carried out by a Sub-Licensee. The majority of the original buffer zone widths were 15 and 30 m. Such widths were normally not conducive to strip cutting due to the lack of wood and, as a result, no strip cutting was carried out.

It was also exceedingly difficult to find cut blocks which were scheduled to be harvested by Sub-Licensees and which were appropriate for selective cutting within the buffer zone. Selective cutting was carried out in only one buffer zone, a 15 m wide zone which ran along the headwaters of the main branch of the Tetagouche River (Block No. 102006783). This was examined at the request of a Sub-Licensee and consisted largely of alders and regeneration with a few scattered, large spruce and fir trees. Permission was given to harvest any softwood trees 25 cm in diameter and over at the stump (outside bark). No machinery was to be operated within 10 m of the stream bank and trees were to be felled toward the cut block so that they would be accessible to the forwarder. The slope was 0-5%.

It should be noted that operators in this area have been permitted in the past to carry out similar types of operations. A description of some of these previous cuts is presented in Appendix I.

Several attempts were made to locate buffer zones which had potential for experimental harvesting. Areas examined on the ground included a 60 m wide buffer on Knoll Spruce Lake (Block No. 102003083), a 60 m wide buffer on Teagues Lake (Block No. 102006283) and a 30 m wide buffer on Nine Mile North Brook (Block No. 102005083). It was found that the prescribed widths were not taken from the high water mark but rather much closer to the standing summer water levels. As a result, buffer zone widths were considerably less than anticipated. Ground conditions were wet as well. In light of these factors it was decided that experimental harvesting should not, and most likely could not, take place in these buffer zones.

A portion of the previously established Nine Mile Brook buffer zone (normal cut blocks harvested prior to this season) was examined with a company representative. The portion examined contained a relatively good volume (approximately 120 m^3/ha) of spruce, fir and cedar; individual tree size was large. The zone averaged 60 m width and was roughly delineated by the crest of a steep slope (approximately 40%). The slope immediately adjacent to the brook was 0-5%. The Licensee wanted to cut patches (over 4 ha in area) or strips within the zone by locating a road down the slope and having trails off this road along the flat area adjacent to the brook. It was felt that such a cut would leave too little protection for wildlife and/or fisheries in this heavily cut watershed. A selective cut was proposed in which machinery would not be allowed to descend the steep slope and trees would thus have to be winched up the slope. This was not acceptable to the Licensee and no harvesting took place.

The Licensee did not present any suggestions for potential sites in spite of numerous opportunities and requests for input. It was decided that any further search would be fruitless.

FOREST REGION 2

UPPER MIRAMICHI LICENSE - BOISE-CASCADE CANADA LTD.

Seven sites under this license were examined for potential of experimental buffer zone harvesting. Cutting prescriptions were written for six of these and operations (sometimes with modifications) were carried out in all six. Three of these operations involved strip cuts in which alternate cutters were asked to extend their trail-cut strips into the buffer zone. This pattern was relatively easy to incorporate into the typical trail-cut operations of this Licensee. To minimize potential of blowdown, orientation of these clearcut strips perpendicular to the prevailing wind was desirable.

Licensee personnel felt that these experimental operations worked well and were pleased with the additional amounts of wood obtained. Forwarding distance of buffer zone wood was considered to be excessive in one of the trail-cut operations (Block No. 204001183). This could have been alleviated by a quicker response to the prescription by the Licensee and a subsequent alteration of the road network prior to commencement of cut block operations.

Unnamed Lake (Block No. 204001183)

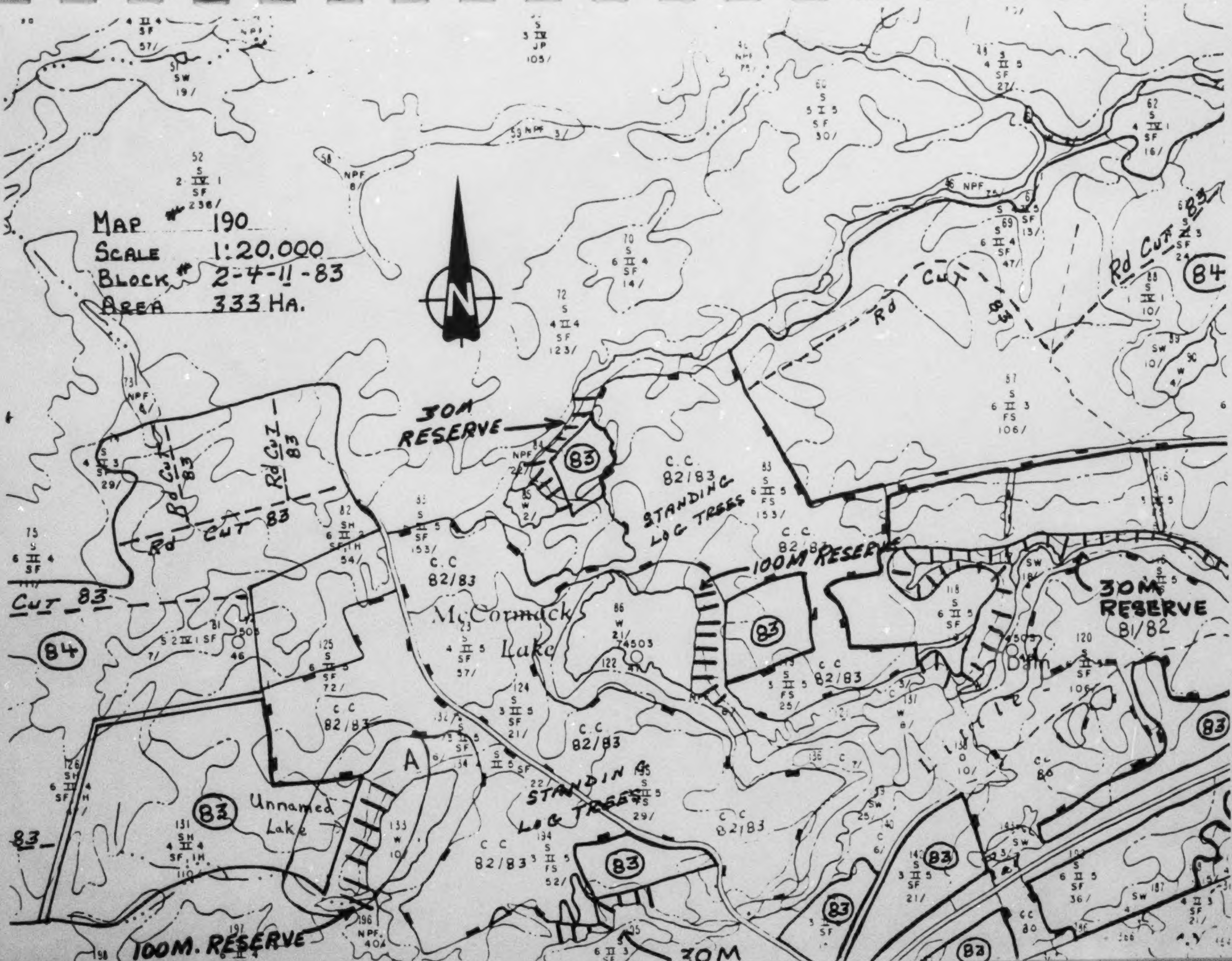
Description: Original buffer zone width was 100 m. Slope was 5-10%; this became a little steeper toward the northern end of the buffer zone in the area designated by "A" (see map). Wood volume was approximately 89-119 m^3/ha and consisted of a mixture of spruce and fir. Some trees were relatively large and the fir was generally in poor shape. Flagging delineating the 100 m buffer zone was already in place. There was little evidence of wildlife usage.

Prescription: The 0-50 m zone was to be an exclusion zone with no harvesting allowed. The 50-100 m zone was to have fifty percent removal by extending and harvesting every other cutter's strip in this trail-cut operation. Thus, an alternate strip cut would be formed. The buffer zone from the previous cut was to be left intact.

Preparatory Work: The 50-100 m zone was to be cruised to determine volumes and species composition, and flagging placed at 50 m from the bank to delineate the "no harvesting" zone. Trail-cut lines delineating the strip cut and "leave" areas were to be flagged.

Results: Cruising of the 50-100 m zone and flagging of the 50 m line were carried out by Branch personnel. Trail-cut lines were flagged by Licensee personnel. This preparatory work was rushed due to a delay by the Licensee in deciding whether or not to carry out the experimental harvesting operation. The cutting operation took place in July. Six strips, estimated to total 1.47 ha, were cut. At the southern end of the buffer a strip was attempted but was terminated when the slope became prohibitive for the porter. Based on cruise estimates of 107.7 m^3/ha for total softwood and 3.4 m^3/ha for total hardwood, this would mean that approximately 158.3 m^3 of softwood and 5.0 m^3 of hardwood were removed.

The completed cut was examined on October 21 with the Regional Biologist. It appeared that the original buffer zone was wider than 100 m as the alternate strip cut zone was approximately 80 m wide while the exclusion zone was 50 m wide. Blowdown was substantial in places along the outer edge of this exclusion zone; this may have been partially a result of equipment pushing trees over. The Regional Biologist was not overly pleased with the operation because the width of the cut strips was generally much wider than the "leave" strips; these "leave" strips were also tapered near the outer end. Although there was no harm to the fisheries resource, it was considered that the greater than 50% removal would impede wildlife usage of this alternate strip cut zone particularly since it was located to the south and east of a rather large clearcut area and would thus receive strong northwest winds.

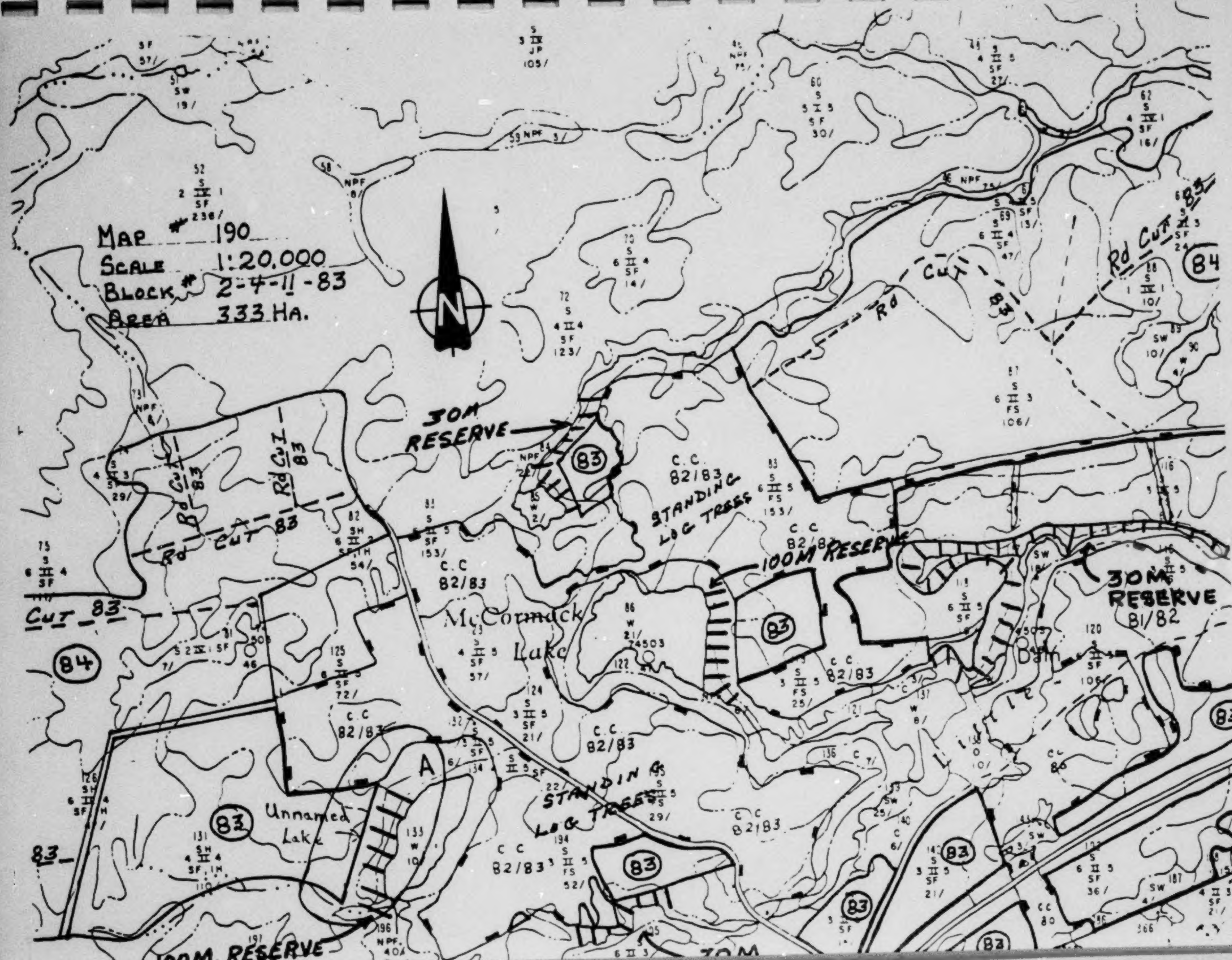


Unnamed Lake (Block No. 204001183)

McCormack Lake (Block No. 204001183)

Description: Original buffer zone width was 100 m. Slope was 0-5%. Wood volume was approximately 60-89 m^3/ha; fir was small and in very poor shape. There were occasional patches of alders, as well as a few large spruce and some hardwood. Blowdown was common. Flagging delineating the 100 m buffer zone was already in place. There was little evidence of wildlife usage.

Prescription: Due to the poor wood quality and amount of cutting which had already taken place around this lake, as well as the immediacy of the cutting operation, it was felt that no experimental harvesting should take place within this buffer zone.


MAP # 190
SCALE 1:20,000
BLOCK # 2-4-11-83
AREA 333 HA.
N
30M RESERVE
30M RESERVE 81/82
100M RESERVE
100M. RESERVE
STANDING LOG TREES
McCormack Lake
Unnamed Lake
Dam
A
C.C. 82/83
Rd Cut 83
Cut 83
Rd Cut I 83
Rd Cut 83
83
84

North Renous Lake (Block No. 204002883)

This block was really a cleanup of a cut carried out during the previous harvesting season. It involved buffer zone establishment not only along North Renous Lake but also along Pear Lake and two streams (see map).

North Renous Lake (Section A)

Description: Original buffer zone width was 200 m. The slope averaged 10-15% but was not uniform. Wood volume was approximately 60-71 m^3/ha. Wood quality was very poor, particularly in the 100-200 m zone; a lot of blowdown (largely fir) and raspberry bushes were seen. Wood quality appeared to be better within 100 m of the lake.

Prescription: The Licensee was given permission to clearcut the 100-200 m zone (0-100 m zone to remain as an exclusion zone) but was not interested, presumably due to the poor wood quality here.

Pear Lake and Stream (Including Section B)

Description: Original buffer zone widths were 100 m along Pear Lake and in Section B and 30 m along the stream (Section C). Flagging delineating these zones was already in place. The slope averaged 10% with some flat and some steep areas. Wood volume was approximately 107-119 m^3/ha. Trees appeared relatively healthy here as compared to those in the buffer zone on North Renous Lake. Stand structure was fairly uniform. Numerous game trails were located throughout the buffer zones.

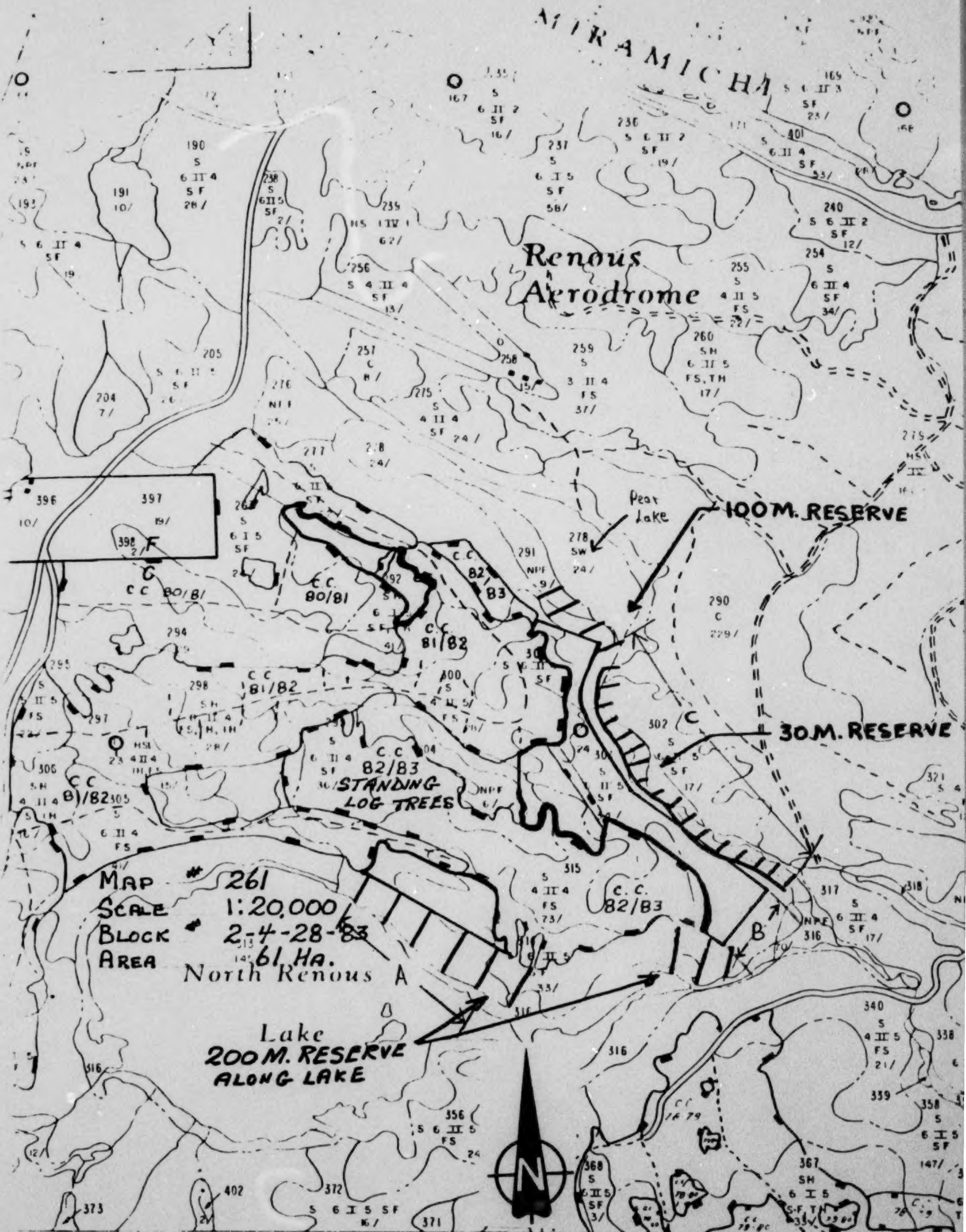
It appeared that the flagging for the proposed cut in Section B ran in a more easterly direction than indicated on the attached map, resulting in less area of 100 m buffer zone before the 30 m buffer zone was reached.

Prescription: It was proposed that an alternate strip cut take place in the outer half of each buffer zone by extending and harvesting every other cutter's strip in this trail-cut operation (fifty percent wood removal). Along Pear Lake and in Section B this would mean a 0-50 m exclusion zone and a 50-100 m alternate strip cut zone. In Section C there would be a 0-15 m exclusion zone and a 15-30 m alternate strip cut zone. The buffer zone associated with the previous cut was to be left intact.

Preparatory Work: The alternate strip cut zones were to be cruised to determine volumes and species composition, and flagging placed at either 50 m or 15 m from the watercourse bank to delineate the exclusion zones. Trail-cut lines delineating the strip cut and "leave" areas were to be flagged.

Results: By the time the Licensee decided to undertake experimental harvesting most of the area had been cut except for Section B and a small portion of Section C. The local foreman did not wish to go back to cut alternate strips because it was a trail-cut operation. On July 27 a 50 m exclusion zone line was flagged in Section B by Branch and Licensee personnel. The local foreman said he would extend the trail-cut lines and carry out the alternate strip cut here. It was felt that a volume and species composition cruise was now unwarranted due to the small area to be experimentally harvested. Based on volumes derived from the operating plan, it was estimated that approximately 117 m^3 of softwood was removed from these strips.

The area was examined on December 8 with the Regional Biologist. The layout of the alternate strip cut appeared to be satisfactory. One "leave" strip was very open, probably due to blowdown which occurred before and after the cutting operation. Blowdown was evident along the periphery of the cut block (particularly in the northern portion of the experimental site) but little was seen along the sides or backs of the strips. The experimental harvesting site faces to the northwest across a large clearcut; the sides of the clearcut strips are perpendicular to this, so little additional blowdown is expected. It is hoped that this type of cut design will enhance wildlife usage of the area.


MIRAMICHI
Renous Aerodrome
North Renous Lake
Peat Lake
100 M. RESERVE
30 M. RESERVE
200 M. RESERVE ALONG LAKE
STANDING LOG TREES
C.C. 80/81
C.C. 81/82
C.C. 82/83
Map # 261
Scale 1:20,000
Block 2-4-28-83
Area 61 Ha.
A
B
C
F
G
N

North Renous Lake (Block No. 204002883)

Underwood Brook - Dungarvon River (Block No. 204004583)

Description: The area applied for under the cut block application included a deer wintering area. It was was learned that approval was given by the Region to harvest Section A and to leave Section B (sections separated by a dashed line on map). Wood volume was approximately 119 m^3/ha of spruce and fir in the 30 m buffer zone along Underwood Brook (in Section A). Slope was greater than 10% along most of this buffer zone.

Prescription: The 0-15 m zone was to be an exclusion zone with no harvesting allowed. The 15-30 m zone was to have fifty percent removal by extending and harvesting every other cutter's strip in this trail-cut operation.

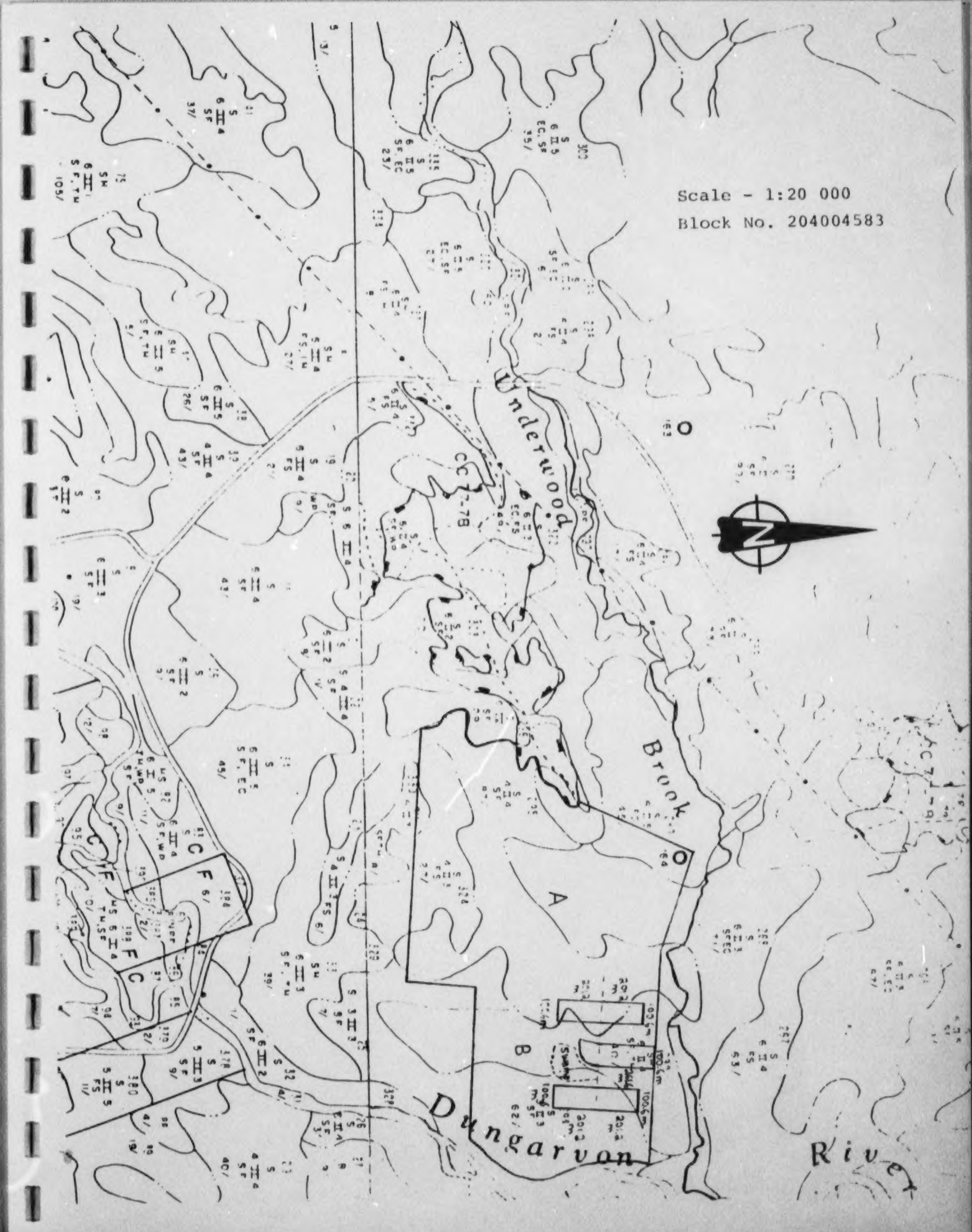
It was apparent that any openings created within Section B would probably be beneficial to deer due to a general lack of browse in the area. Three strip cuts were suggested for inclusion in the cutting operation, to be laid out in consideration of the proposed road network and what was thought to be mature stands.

Preparatory Work: Licensee, Regional and Branch personnel flagged the three strips in Section B. A swampy area was encountered in flagging the middle strip; this necessitated a modification of the shape of the cut and a slight reduction in the total area to be cut. Total area encompassed by the three strips was approximately 11 ha. It was decided that the 15 m buffer zone line and trail-cut strips within this zone would be flagged by the Licensee. The 30 m buffer zone line was already in place. Due to the small area involved a separate cruise was deemed unnecessary.

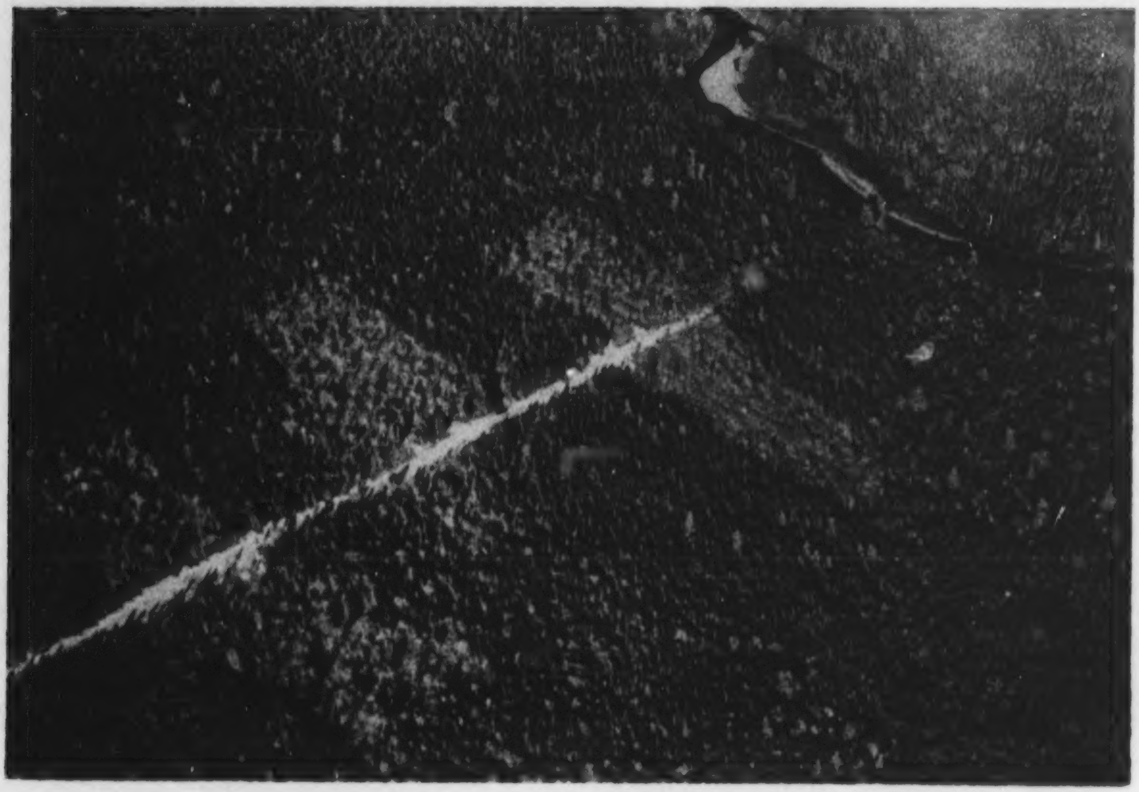
Results: The cutting operation took place in late summer and early fall. The three strips in Section B were harvested while no strips in the 30 m buffer zone along Underwood Brook were cut. It was decided by Licensee personnel that the amount of wood to be obtained was not enough to justify laying out these strips.

The site was visited on November 8 with the Regional Biologist. A surprising amount of wood (cedar, hardwood and unmerchantable species) was left standing in the three cut strips. It was felt that this would provide a good interspersion of browse and cover. The boundary lines were respected. It was concluded that the strips were satisfactorily harvested. Based on cruise data derived from the operating plan it was estimated that 1 315 m^3 of softwood was removed from these strips.

During examination of Section A a small tributary which drained into Underwood Brook was discovered to have been severely disturbed by repeated machine crossings; at the time of examination it was carrying a high sediment load.


Underwood Brook
Dungarvon River
CC7-78
A
B
C F
F C
N

Scale - 1:20 000
Block No. 204004583



Underwood Brook - Dungarvon River (Block No. 204004583)

Tributary of the Little South Branch of the Big Sevogle River (Block No. 204002283)

Only the area north of the road (see map and copy of cut photo) was considered for experimental buffer zone harvesting during the current year.

Description: Original buffer zone width was 60 m; flagging for this was already in place. Harvesting of normal cut block had been completed. Slope was 0-5%. There was good stocking of fir and spruce (estimated at 137 m^3/ha from the operating plan); some trees were large but the majority were relatively small. The fir had sustained heavy budworm damage. The buffer zone was intersected near its center by a small strip of alders running roughly in an east-west direction. Stand structure was more uniform south of this alder strip. One large game trail was seen in the buffer zone.

Prescription: The 0-20 m zone was to be an exclusion zone with no harvesting allowed. The 20-60 m zone was to be cut in alternate strips. The width of the cut strips would be roughly 12-15 m, created by two passes of a Koehring Feller-Forwarder which was used to harvest the cut block. "Leave" strips had to be the same width as the cut strips; however, permission was given to harvest large trees from these "leave" strips using the boom of the machine, provided that the machine did not leave the cut strip.

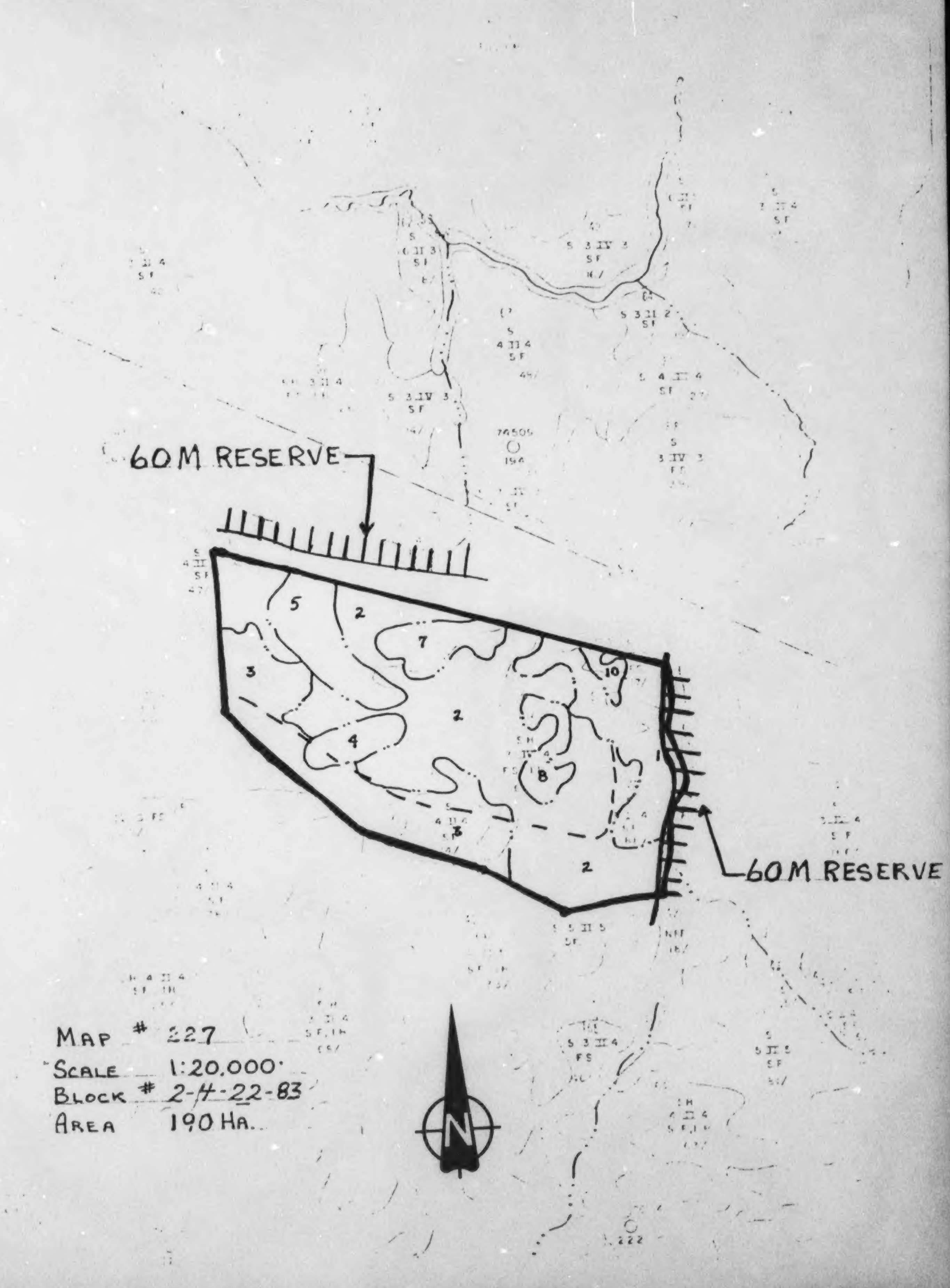
Preparatory Work: Flagging was to be placed at 20 m from the stream to delineate the exclusion zone. The 20-60 m zone was to be cruised to determine volumes and species composition.

Results: Flagging and cruising were carried out by Regional personnel. A softwood (spruce and fir) volume estimate of 170 m^3/ha was obtained from this cruise. The local foreman flagged in the center line of the strips to be cut; the machine left these flagged trees on the first pass through the strip and removed them on the second pass.

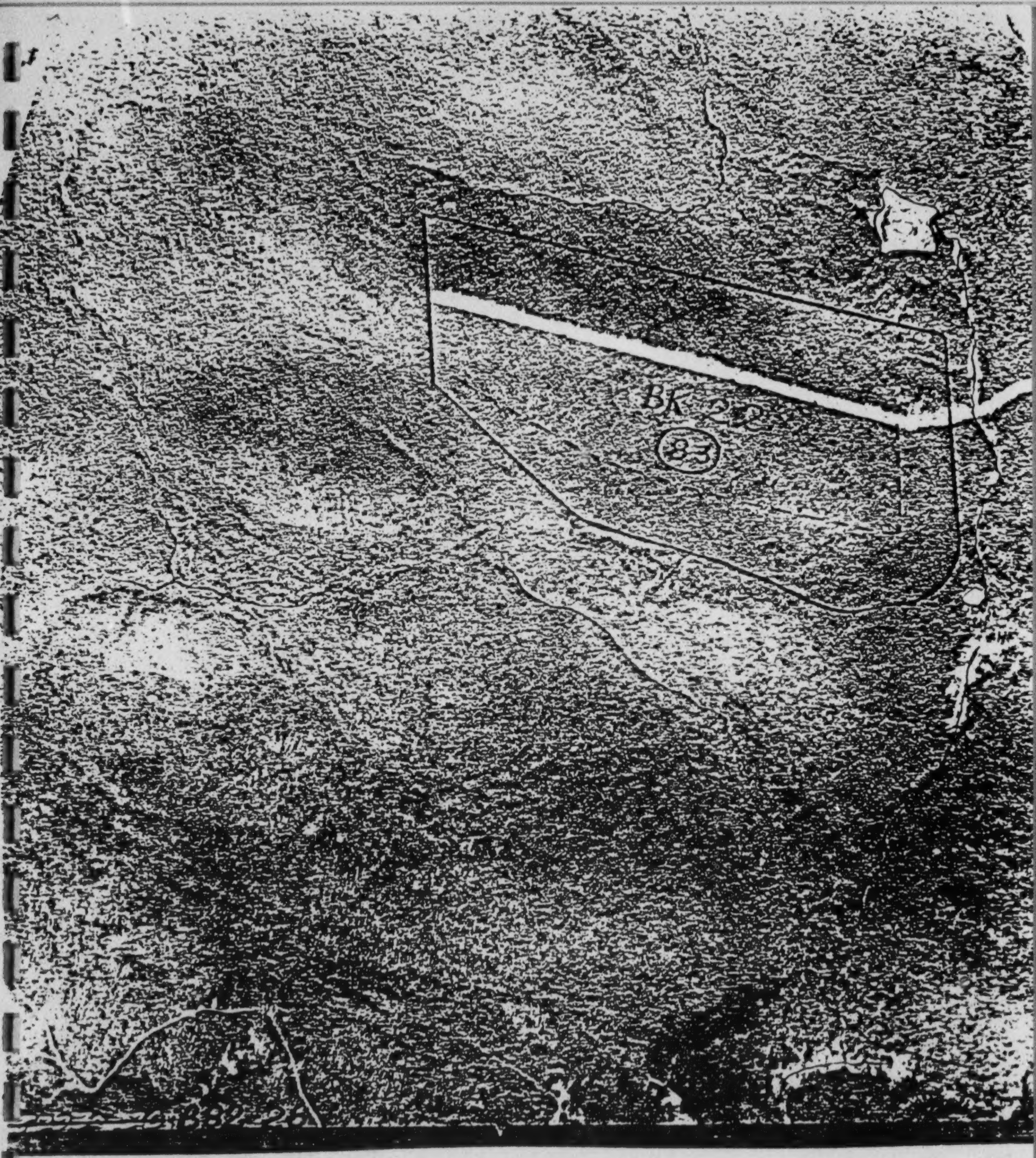
Three strips were cut and total volume of fir and spruce removed was 209 m^3 (scaled by Branch personnel during the cutting operation). Experimental harvesting was completed during one work shift.

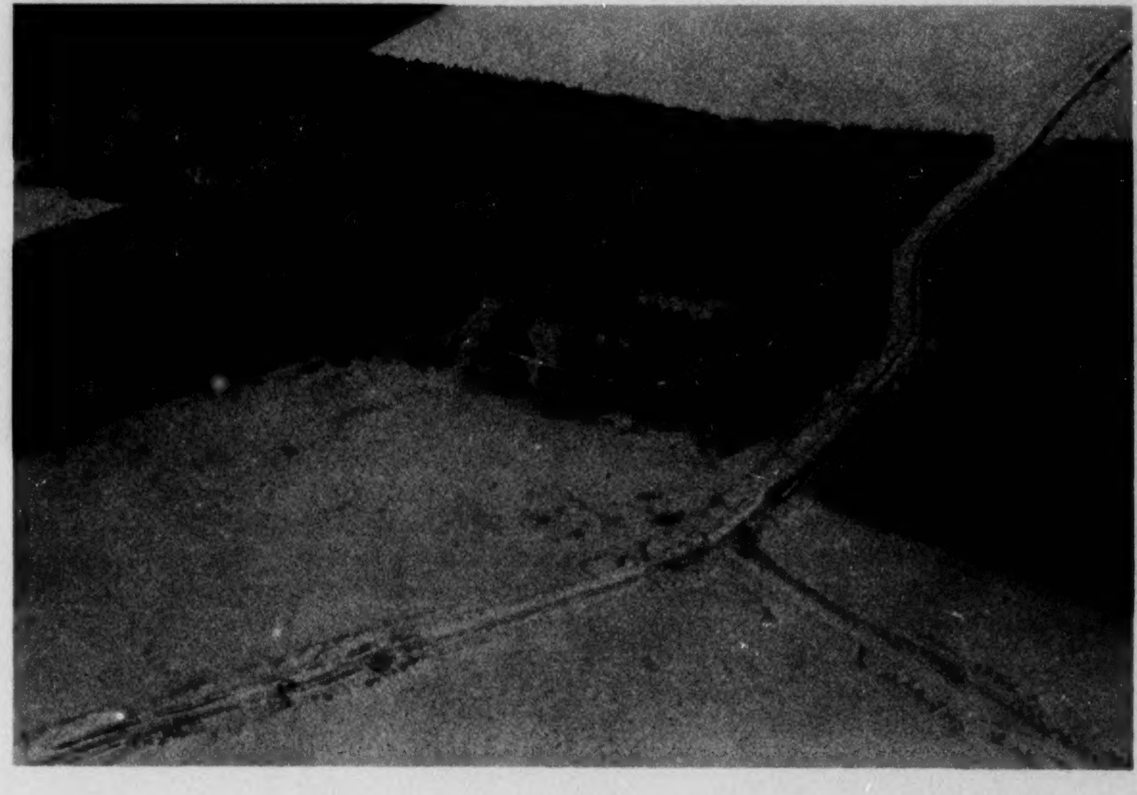
The site was examined on October 21 with the Regional Biologist. The operation appeared to have been well done. The cut strips were uniform and straight and there was little damage to the residual trees. Width of "leave" strips was ample and blowdown was minimal. In addition, no damage as a result of the removal of large trees from these "leave" strips was evident. One more strip could have been cut but was not as the machine was moved to a new area during the work shift change.

Aerial pictures of this area were taken on February 2. Blowdown now appeared to be substantial; the most northerly "leave" strip had completely blown down while approximately half of the middle "leave" strip had blown down. This appeared to have been largely produced by the orientation of these "leave" strips and the overall susceptibility of the relatively dense, small-diameter spruce and fir to blowdown.


60M RESERVE
5
2
7
3
10
2
4
8
3
2
60M RESERVE

MAP # 227
SCALE 1:20,000
BLOCK # 2-14-22-83
AREA 190 HA.


BK 22
83
B82-26



Tributary of the Little South Branch of the
Big Sevogle River (Block No. 204002283)

Bear Lake Area (Block Nos. 204005783, 204007984)

The following applies to the buffer zone around Cuckoo and Reardon Lakes (see map and copy of aerial cut photo) and includes both a 1983 and a 1984 cutting block (which the Licensee was given permission to commence in 1983 and its number was subsequently changed to 204007983).

Description: Original buffer zone width was 100 m. Slope averaged 0-5% but generally was a little steeper (5-10%) near the lakes. Wood was predominately fir (estimated softwood volume of 116 m^3/ha taken from operating plan). Individual tree size was relatively small and budworm damage was substantial in places, particularly adjacent to the cut blocks. Stand structure was uniform. Cutting adjacent to the buffer zone had been completed (100 m flagging already in place) and some wood had been removed by porters (trail-cut operation) at the time of examination.

Prescription: The 0-50 m zone was to be an exclusion zone with no harvesting allowed. An alternate strip cut was to take place in the 50-100 m zone, with cut and "leave" strips approximately 30 m in width, in the hatched areas indicated on the copy of the aerial cut photo.

Preparatory Work: The strips to be clearcut were to be flagged out and an estimate determined of the volumes removed.

Results: Strips were flagged by Licensee and Regional personnel. Crews were brought back into the area and the experimental harvesting was carried out during the latter part of September and into October. It was estimated that 403 m^3 of softwood were removed from 4.5 ha of clearcut strips.

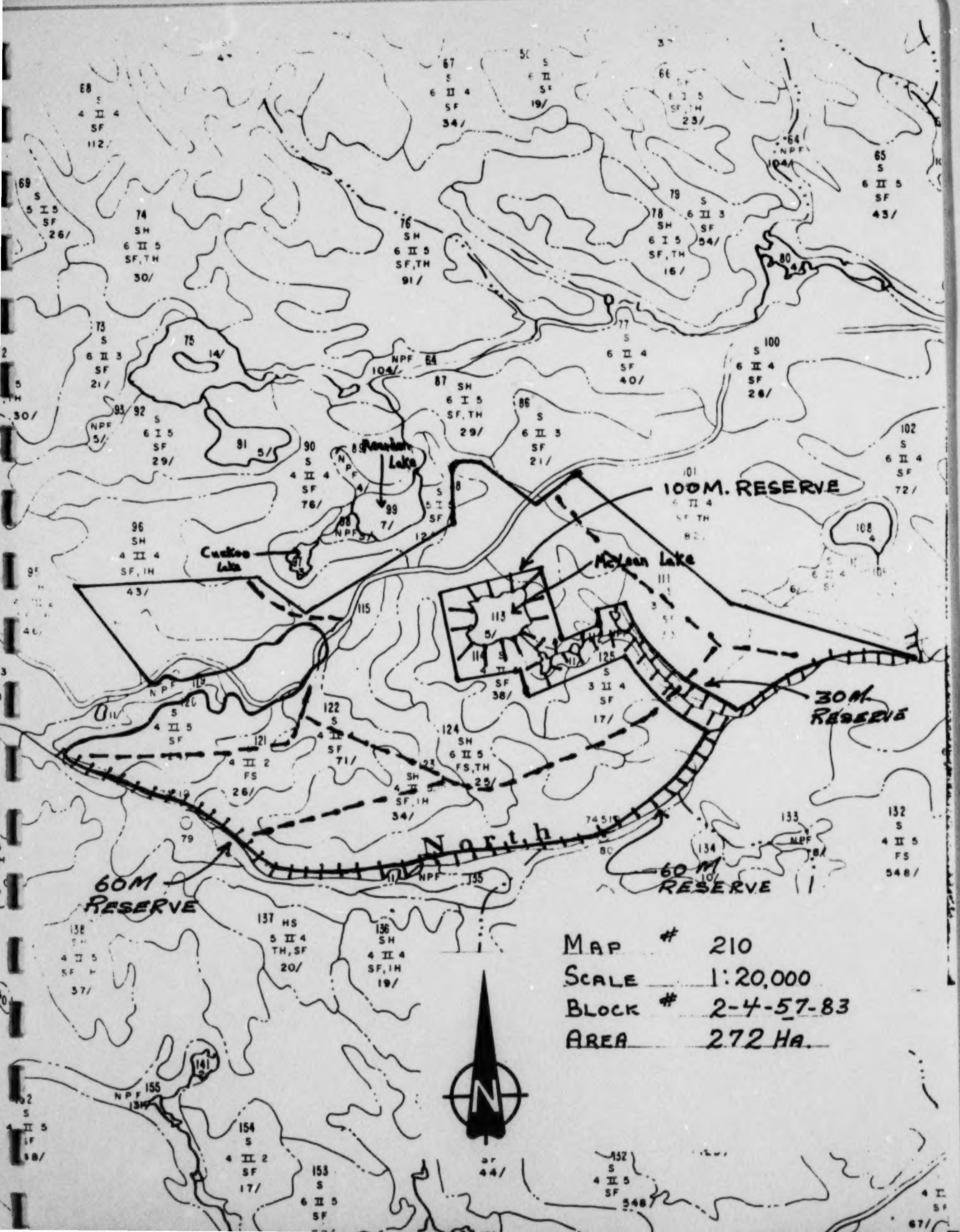
The site was visited on November 7 with the Regional Biologist. The harvesting operation appeared to have been carried out satisfactorily. Clearcut strips ranged from 20 to 30 m in width, with an equal amount of width in the "leave" strips. Strips appeared to have been well flagged and there was little evidence of removal of trees from "leave" strips.

The following applies to the buffer zone around McLean Lake (see map and copy of aerial cut photo).

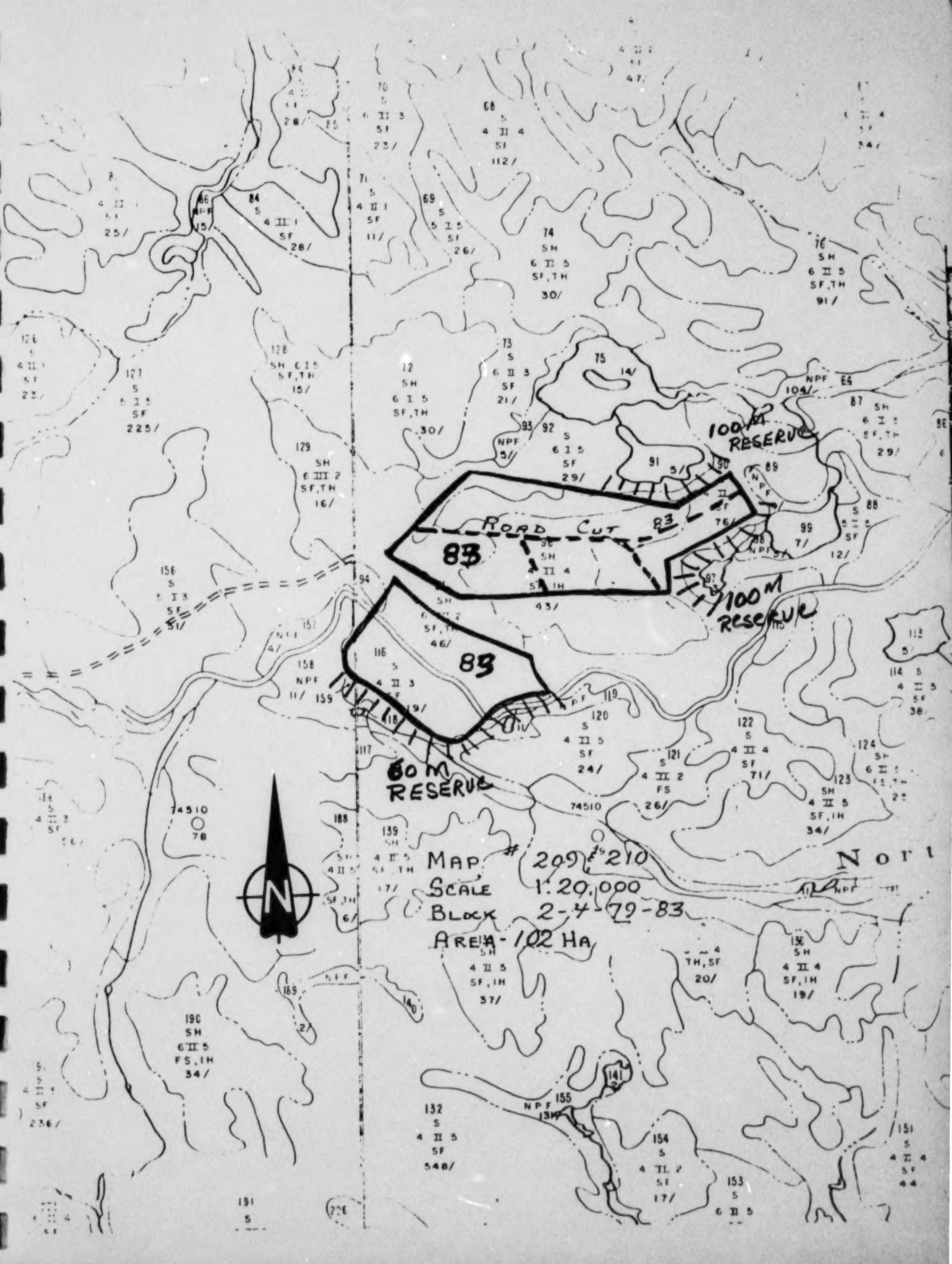
Description: Original buffer zone width was 100 m. Slope was 5-10%. In the northeast corner of this buffer zone fir predominated and was generally small and heavily budwormed. The remainder of the zone consisted of a higher proportion of hardwood. Harvesting in the adjacent cut block had been completed.

Prescription: The northeast corner (hatched area on the copy of the aerial cut photo) was to be clearcut; it was susceptible to blowdown due to the predominately northwesterly wind. Maximum depth of cut could not be more than 50 m from the corner of the standing timber.

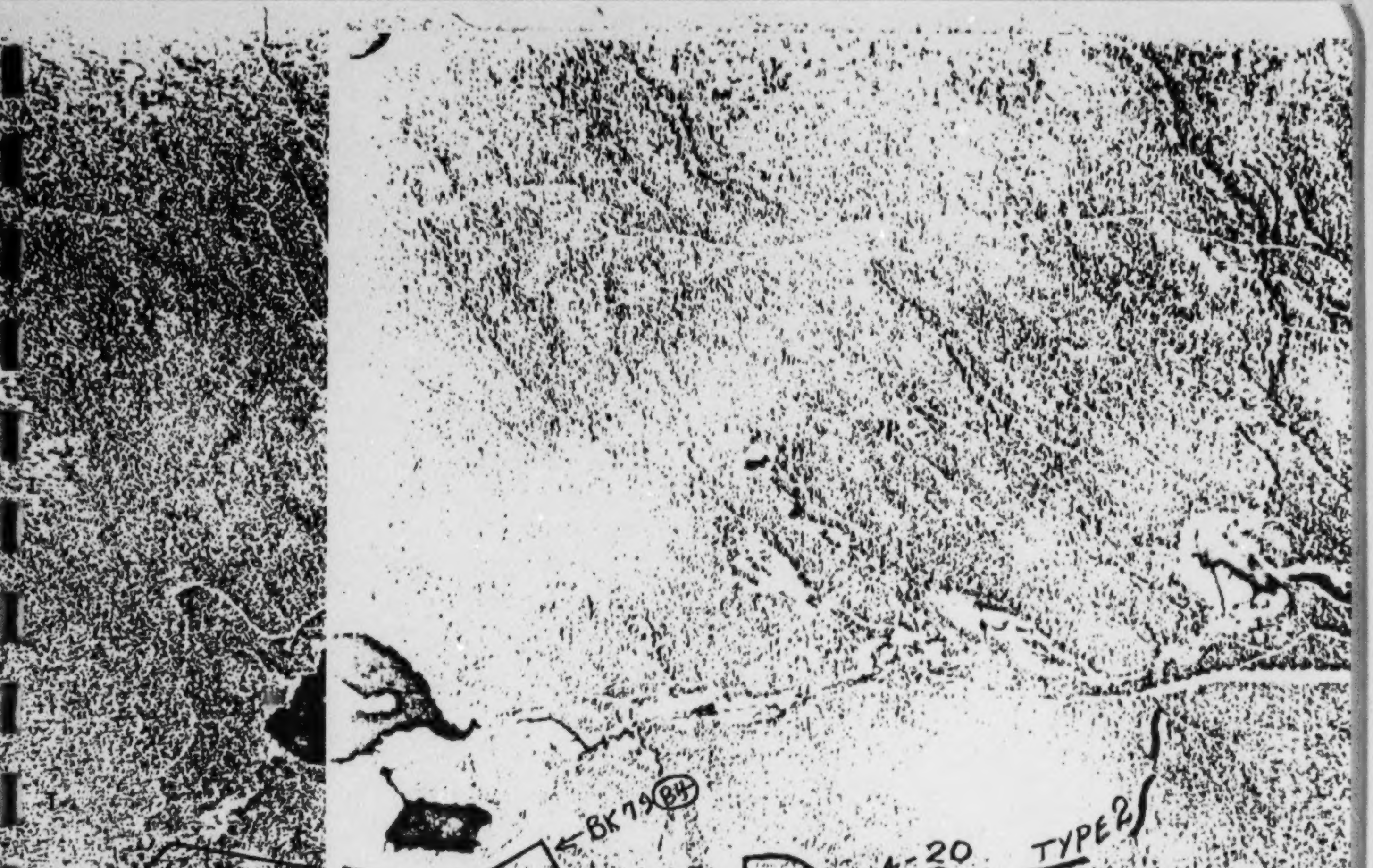
Results: Prescription was carried out as indicated.


100M. RESERVE
McLean Lake
Cuckoo Lake
Lake
30M RESERVE
60M RESERVE
60M RESERVE
North
NPF
N

MAP # 210
SCALE 1:20,000
BLOCK # 2-4-57-83
AREA 272 HA.


ROAD CUT
83
83
83
100M RESERVE
100M RESERVE
60 M RESERVE
N
Nort
74510
74510

MAP # 209 & 210
SCALE 1:20,000
BLOCK 2-4-79-83
AREA - 102 HA


Rd Cut 8
BK 79 84
83
BK 79
84
BK 79 84
Rd Cut 83
A-20
TYPE 2
BK 57
83
BK 57
83

Bear Lake Area (Block Nos. 204005783, 204007984)

South Little River Lake (Block No. 204010483)

Description: Original buffer zone width was 100 m. Slope varied between 5-10% and greater than 10%; the entire zone was situated on a gradual slope which continued upward beyond the 100 m distance. In places a fairly well defined crest could be seen but this was not continuous. Wood volume was approximately 107 m^3/ha. The trees were generally small and dense. An area of nonproductive forest (wet ground and alders) extended through the northerly third of the buffer zone. Blowdown was substantial in places; direction of blowdown was uniform, being associated with wind coming from a WNW direction.

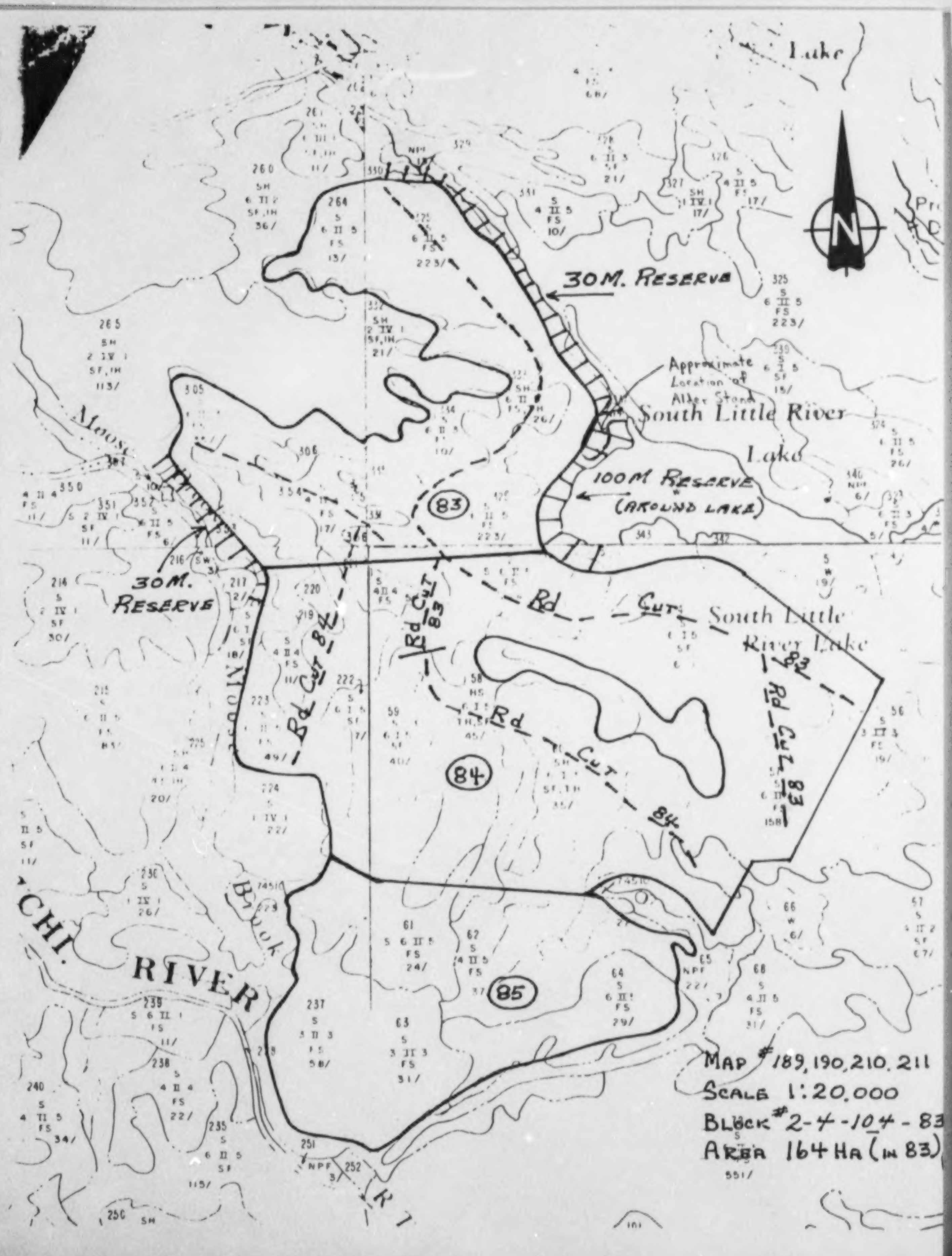
Prescription: It was originally proposed that an alternate strip cut pattern be carried out, similar to that done with other trail-cut operations under this license. However, the local foreman expressed a strong interest in utilizing a skidder to carry out a selective cut of large sawlog material within the buffer zone. He felt that he could do a good job by felling trees into alder patches, concentrating skidtrails in such patches and by leaving those trees which could not be felled or skidded without creating a lot of damage to the residual vegetation. It was decided to let him proceed with this selective cut throughout the entire buffer zone.

Preparatory Work: The original buffer zone line of 100 m was already in place. No other preliminary work was necessary.

Results: The selective cut was carried out in the early fall using a CJ-5 skidder and a two-man crew. The operation required approximately 80 man-hours and produced 111 m^3 of spruce and pine sawlog material and 39 m^3(st) of spruce and fir pulpwood.

The site was visited on October 21 with the Regional Biologist, who was very pleased with the operation. Skidtrails were narrow and there appeared to be little damage to the residual vegetation. Soil disturbance was minimal and the operation in no way harmed the water quality of the lake. Small patches created by sawlog removal were predicted to provide good areas for browse in the near future.

The 30 m buffer zone of a small stream which drained into the lake was also examined for potential of experimental harvesting. However, the steep slope here (greater than 60%) prohibited any formulation of a harvesting plan.


Lake
30M. Reserve
Approximate Location of Alder Stand
South Little River Lake
100M Reserve (Around Lake)
Moose
30M. Reserve
Moose Brook
83
84
85
Rd Cut 84
Rd Cut 83
Rd Cut
South Little River Lake
Rd Cut 83
Rd Cut 83
Rd Cut 84
CHI. RIVER
Map #189, 190, 210, 211
Scale 1:20,000
Block #2-4-104-83
Area 164 Ha (in 83)

LOWER MIRAMICHI LICENSE - ACADIA FOREST PRODUCTS LTD.

Five sites under this license were examined for potential of experimental buffer zone harvesting. Cutting prescriptions were written for three of these. Harvesting was carried out at one of the other two sites in the manner proposed by the Licensee in its operating plan. The fifth site was deemed to be inoperable. One of the three sites for which a cutting prescription was formulated was not experimentally harvested due to a flagging problem. Thus, three buffer zones were experimentally harvested; one involved strip cuts in a trail-cut operation and the other two involved selective cuts in tree-length skidder and horse operations. The Licensee was generally pleased with these operations although the amount of additional wood obtained from two of these was not excessive.

Semiwagan River (Block No. 203002283)

The area proposed for cutting had already been partially harvested during the previous season.

Description: Original buffer zone width was 60 m. The boundary of the entire block was already flagged out. In the portion of the block previously cut this flagging was at 60 m; however, in the portion to be harvested this season the flagging had been placed considerably closer to the river. Slope was 0-5% overall. Wood volume was approximately 119 m^3/ha, consisting largely of spruce and fir. A number of game trails were evident in the buffer zone.

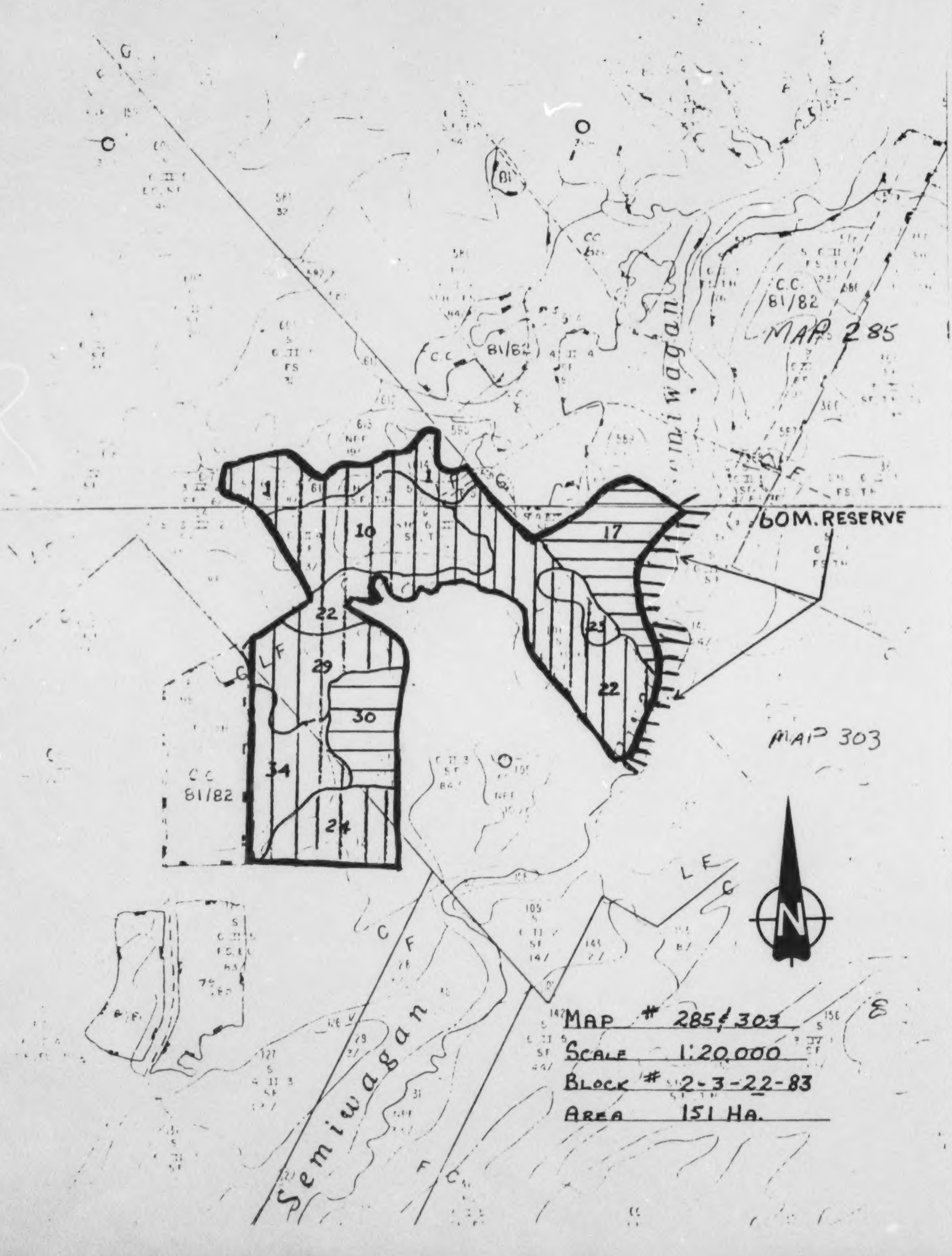
Prescription: The area was to be reflagged to ensure that a 60 m buffer zone would remain. The 0-15 m zone was to be an exclusion zone with no harvesting allowed. The 15-60 m zone was to have fifty percent removal by extending and harvesting every other cutter's strip in this trail-cut operation (alternate strip cut). Removal of wood up to the bank of a small stream within the cut block would be permitted as long as care was taken not to damage the stream bed or bank.

Preparatory Work: The 15-60 m zone was to be cruised to determine volumes and species composition. Flagging was to be placed at 15 m from the river bank to delineate the exclusion zone. Reflagging of the 60 m line to delineate the alternate strip cut zone was also to be carried out.

Results: Cruising and flagging were carried out by Regional personnel. A softwood volume estimate of 138.5 m^3/ha (119.5 m^3/ha for spruce and fir) was obtained. However, the 60 m line was apparently not reflagged along the portion of the block to be harvested this season. This was not discovered until the majority of the area had been cut (in June) to the old flagging, which was much closer to the brook. Extension of trail-cut lines was now less practical as the cutters had already moved further south along the block and did not wish to come back. Additionally, the southern portion of this block was very wet and cutters were being moved to other blocks. The Licensee indicated that a few strips would be cut in the southern portion of the buffer zone late in the summer but this never took place.

This problem appears to have been produced by a lack of effective communication among and between Regional and Licensee staff.

The site was visited on October 12 with the Regional Biologist. No 60 m flagging in the recently harvested portion was evident. In a couple of places trees had been removed from the 0-15 m exclusion zone (there was considerable discrepancy in the location of the 15 m and the old flagging). One large pine had been felled across the river (knocked down several fir as well) and left there when it was apparently determined to be unmerchantable. Due to the difficulties encountered here, nothing further can be said regarding the cut layout or overall analysis.


MAP 285
MAP 303
60M. RESERVE
Semiwagan
Semiwagan
C.C. 81/82
C.C 81/82
C.C 81/82
1
1
10
17
22
22
23
29
30
34
24
C L F
L F C
C F
F C
81
N

MAP # 285 & 303
SCALE 1:20,000
BLOCK # 2-3-22-83
AREA 151 HA.

Semiwagan River (Block No. 203002383)

The buffer zone examined for potential of harvesting was the 60 m zone located on the east side of the cut block, not the 30 m zone on the northwest side (see map).

Description: Original buffer zone width was 60 m. The slope was greater than 10%; the crest of this slope occurred approximately 40 to 60 m away from the river and appeared to be generally closer to the river in the southern portion of the zone. Wood volume was approximately 89 m^3/ha and consisted largely of spruce and fir. Budworm damage to the fir ranged from moderate to severe.

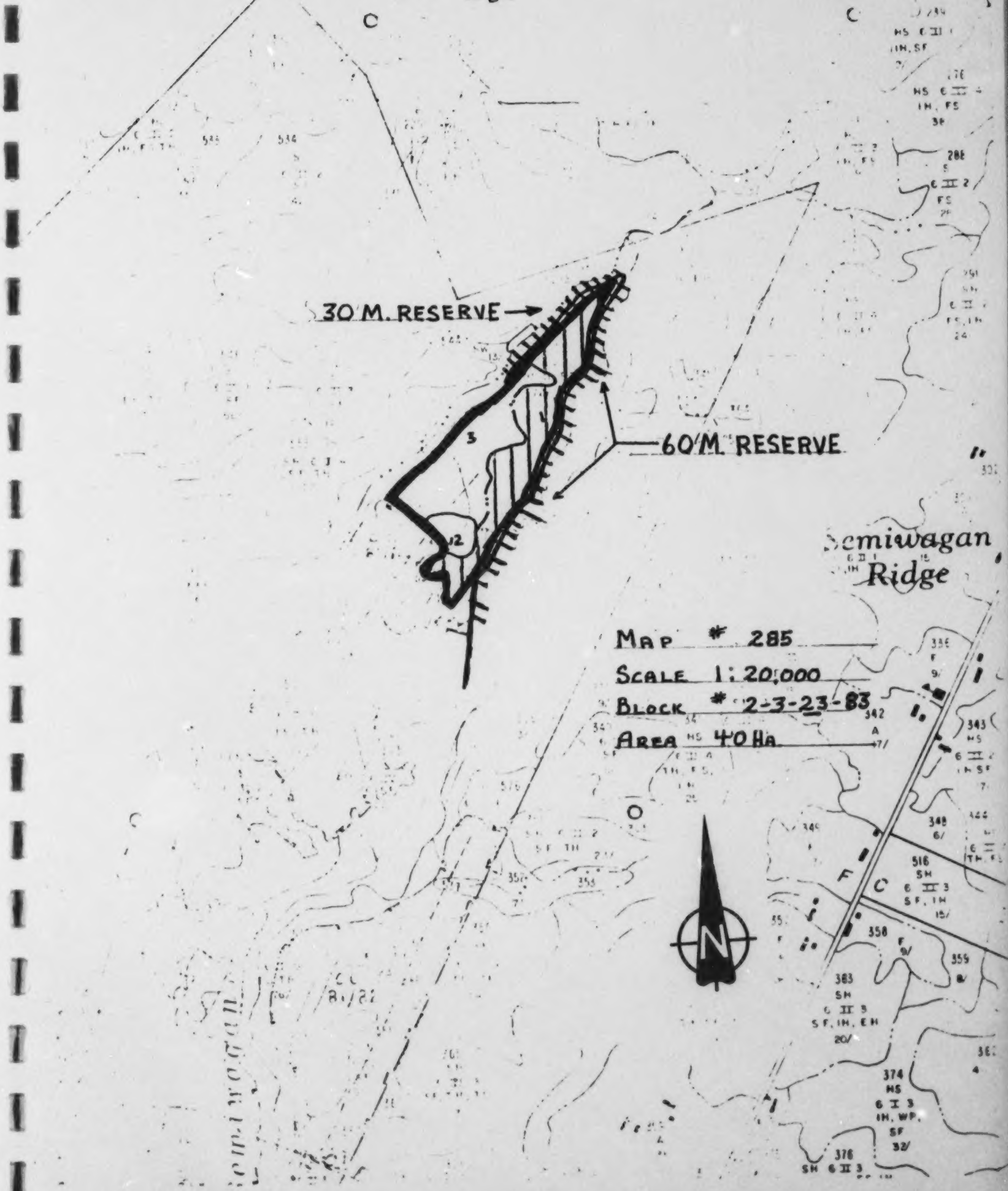
Prescription: The 0-15 m zone was to be an exclusion zone with no harvesting allowed. The 15-60 zone was to have fifty percent removal by extending and harvesting every other cutter's strip in this trail-cut operation (alternate strip cut).

Preparatory Work: The 15-60 m zone was to be cruised to determine volumes and species composition. Flagging was to be placed at 15 m from the river bank to delineate the exclusion zone and at 60 m to delineate the alternate strip cut zone. Trail-cut lines were to be extended to the 15 m line.

Results: All preparatory work was carried out by Licensee personnel. The cutting operation took place during the summer. Based on a cruise estimate of 94 m^3/ha for total softwood, it was estimated that approximately 319 m^3 of softwood was removed from the clearcut strips.

The site was visited on October 12 with the Regional Biologist. The layout of the cut appeared fine; clearcut and "leave" strips were not well defined in places, due to frequent patches of unmerchantable and/or young vegetation and openings. Occasional small piles of merchantable wood not collected by the porter were seen. These were either among slash and young growth (hard to see) or at the base of relatively steep slopes (which apparently the porter operator did not wish to go down). Upon seeing the 0-15 m exclusion zone (which was laid out correctly) after the cutting operation, the Regional Biologist felt that such a width was too narrow to be effectively utilized by wildlife although it would protect the fisheries resource.

MAP
285


30 M. RESERVE
60 M. RESERVE
Semiwagan
Ridge
N

Map # 285
Scale 1:20,000
Block # 2-3-23-83
Area 40 Ha.

Cains River (Block No. 203013083)

Description: Original buffer zone width was 200 m. The slope was extremely steep; an essentially vertical cliff followed along the river. This cliff was inoperable. Pine was common in the predominately softwood cut block. Hardwoods predominated from the crest of the cliff to the river.

Prescription: No harvesting could take place within this buffer zone. For aesthetic and slope stability reasons, it was recommended that a 60 m exclusion zone from the crest of the cliff be enforced.

Six Mile Brook (Block No. 203001383)

This cut block was located on the downstream (northwest) side of the road and to the east of the stream (see map and copy of aerial cut photo). A cleanup operation (Block No. 203001083), located on the upstream side of the road and to the west of the stream, was also examined for potential of buffer zone harvesting; this was deemed impractical largely due to steep slopes. Both blocks involved skidder tree-length operations.

Description: Original buffer zone width was 60 m. Overall slope was greater than 10%; a pronounced crest existed along the entire buffer zone. Stand types were variable within this buffer zone. In the section furthest downstream (A) individual tree size was relatively large (mostly white and jack pine with some spruce and fir - approximately 119 m^3/ha). In the most westerly section (B) the predominant species were spruce and fir, which were generally smaller (but denser, so volume remained the same) and appeared to be in poor condition. The slope in this section was more gradual and the crest less well defined. In the remaining section (C) the crest again became well defined and the slope here was inoperable. The pine in this section appeared to be young and healthy.

Wildlife usage of the buffer zone appeared to be extensive as evidenced by game trails, browsed vegetation and scats.

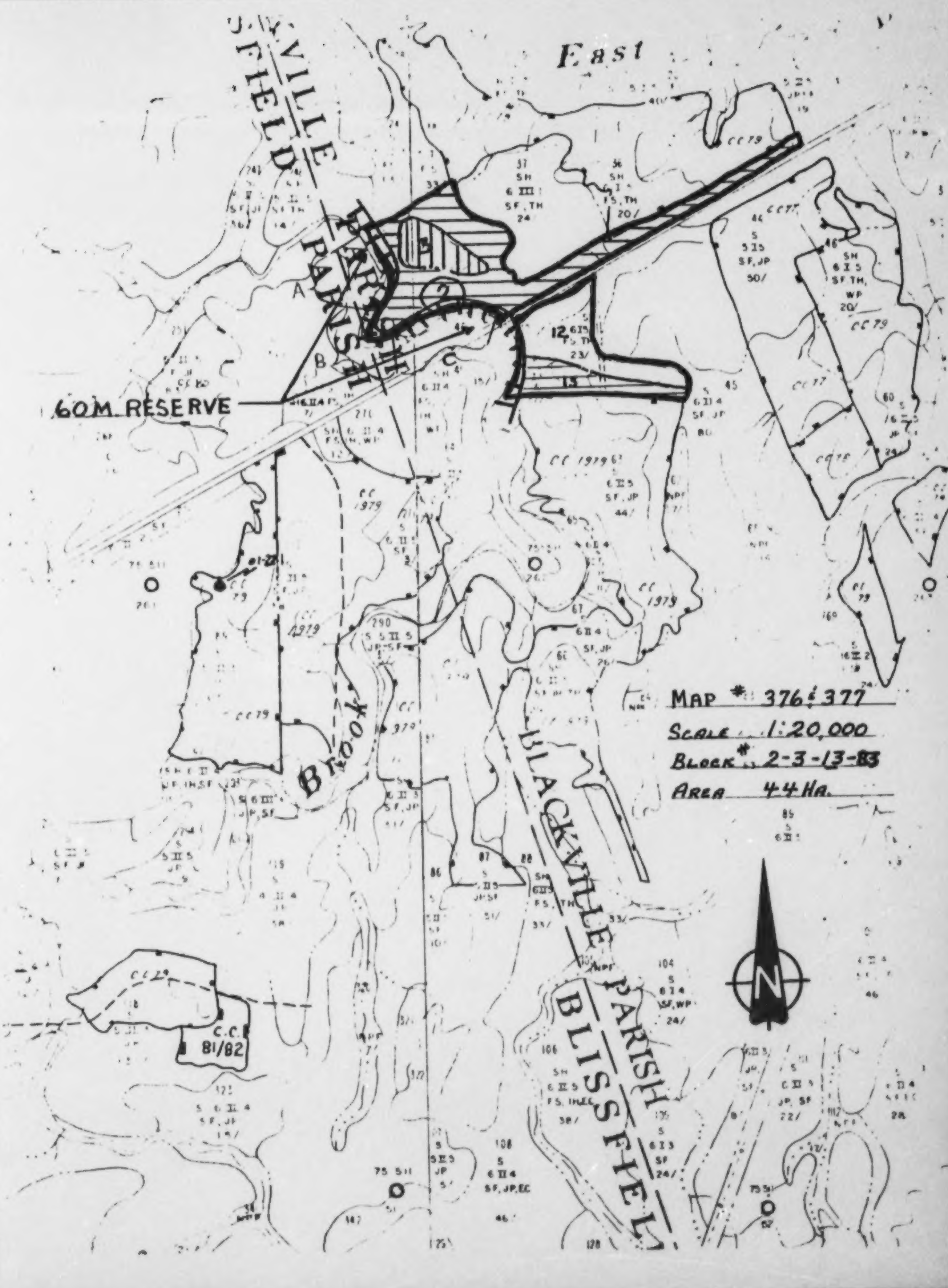
Prescription: The 0-30 m zone was to be an exclusion zone with no harvesting allowed. In the 30-60 m zone a selective cut of all spruce and fir 25 cm in diameter and over at the stump and all pine 36 cm in diameter and over at the stump (outside bark) was to take place. All unmerchantable trees were to be left standing and no machinery was to be operated over the well defined crest in Sections A and C.

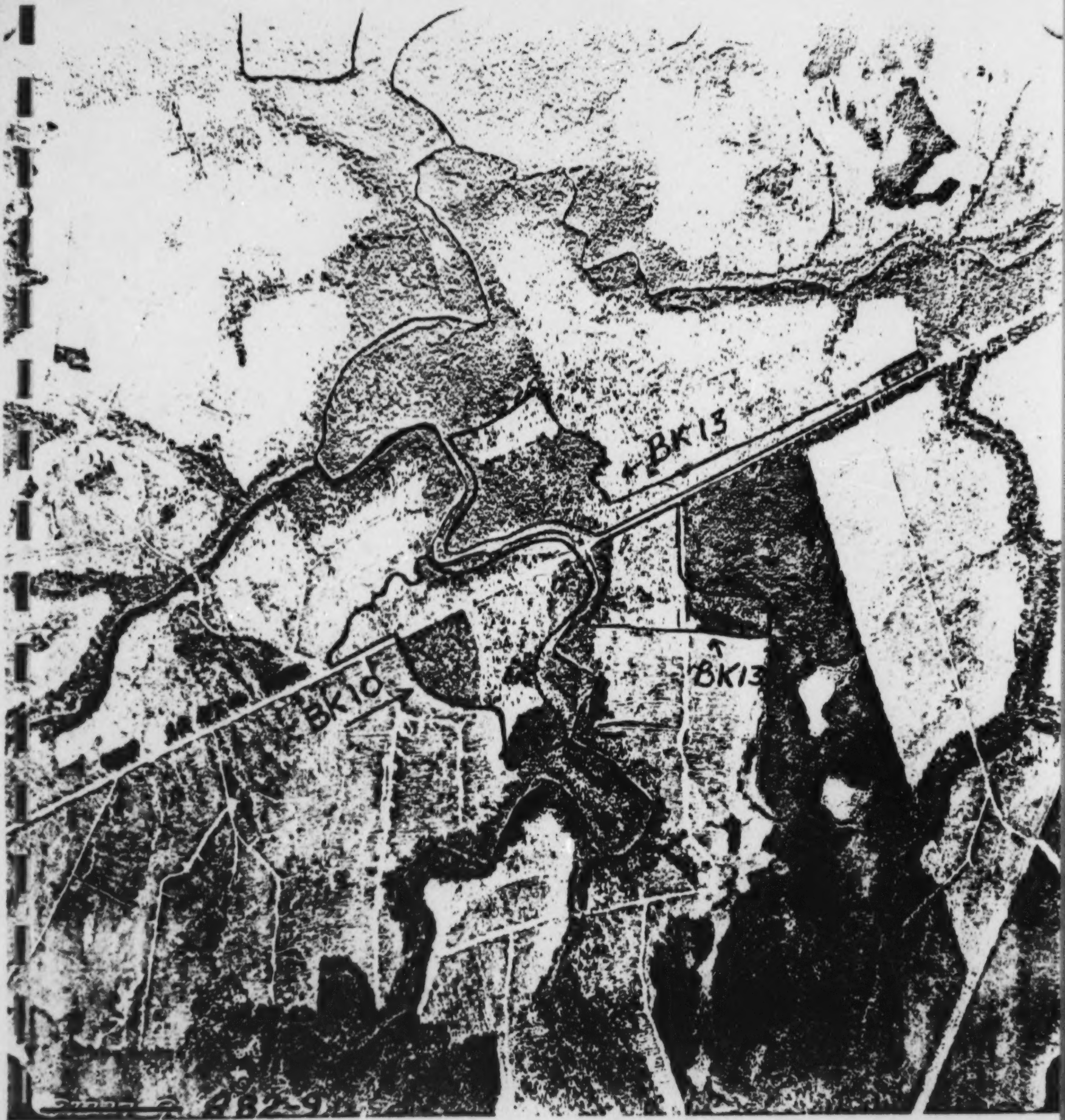
It was originally planned that a clearcut could take place within the buffer zone in Section B by flagging two skidder trails from the 30 m line to within 10 m of the stream but it was decided that such a prescription would be too complicated to carry out.

Preparatory Work: The 30-60 m zone was to be cruised to determine volumes and species composition, and flagging placed at 30 m from the stream bank to delineate the exclusion zone. Flagging was already in place for the 60 m line; it was felt, however, that this was too close to the crest of the slope in Section C and should be moved back a further 30 m.

Results: The Licensee indicated that this cut would not take place until the end of July. However, on July 7 word was received that harvesting had been taking place there for approximately three weeks; the Licensee's head office was unaware of this. The site was visited again and it was found that the 60 m line in Section C had not been reflagged; the area had been clearcut to the original flagging, precluding any possibility of selective harvesting in this section. Flagging of the 30 m line and cruising of the 30-60 m zone in Sections A and B were then carried out by Regional and Branch personnel. Volume estimates of 37.8 m^3/ha for spruce and fir and 220.8 m^3/ha for total softwood (included a lot of large diameter, "limby" pine) were obtained from this cruise. The selective cut was then carried out. The prescription was slightly modified in that the cutters were allowed to take jack pine down to 25 cm in diameter (similar to spruce and fir); the minimum diameter for white pine remained at 36 cm. An estimate of the volume removed was not available.

The completed cut was examined on October 12 with the Regional Biologist. The operation appeared satisfactory. Some portions of the zone were opened up more than others and the skidder trails necessitated some removal of small trees. This did not appear to be excessive. A few residual trees had been scraped during the extraction process. One portion of the proposed selective cut area was untouched, presumably due to confusion with the flagging.


East
VILLE PARISH
FIELD
PARISH
60M. RESERVE
A
B
C
2
12
13
BROOK
BLACKVILLE PARISH
BLISSFIELD
C.C. 81/82
CC 1979
N
MAP # 376 & 377
SCALE 1:20,000
BLOCK # 2-3-13-83
AREA 44 HA.


BK13
BK13
BK10
4829

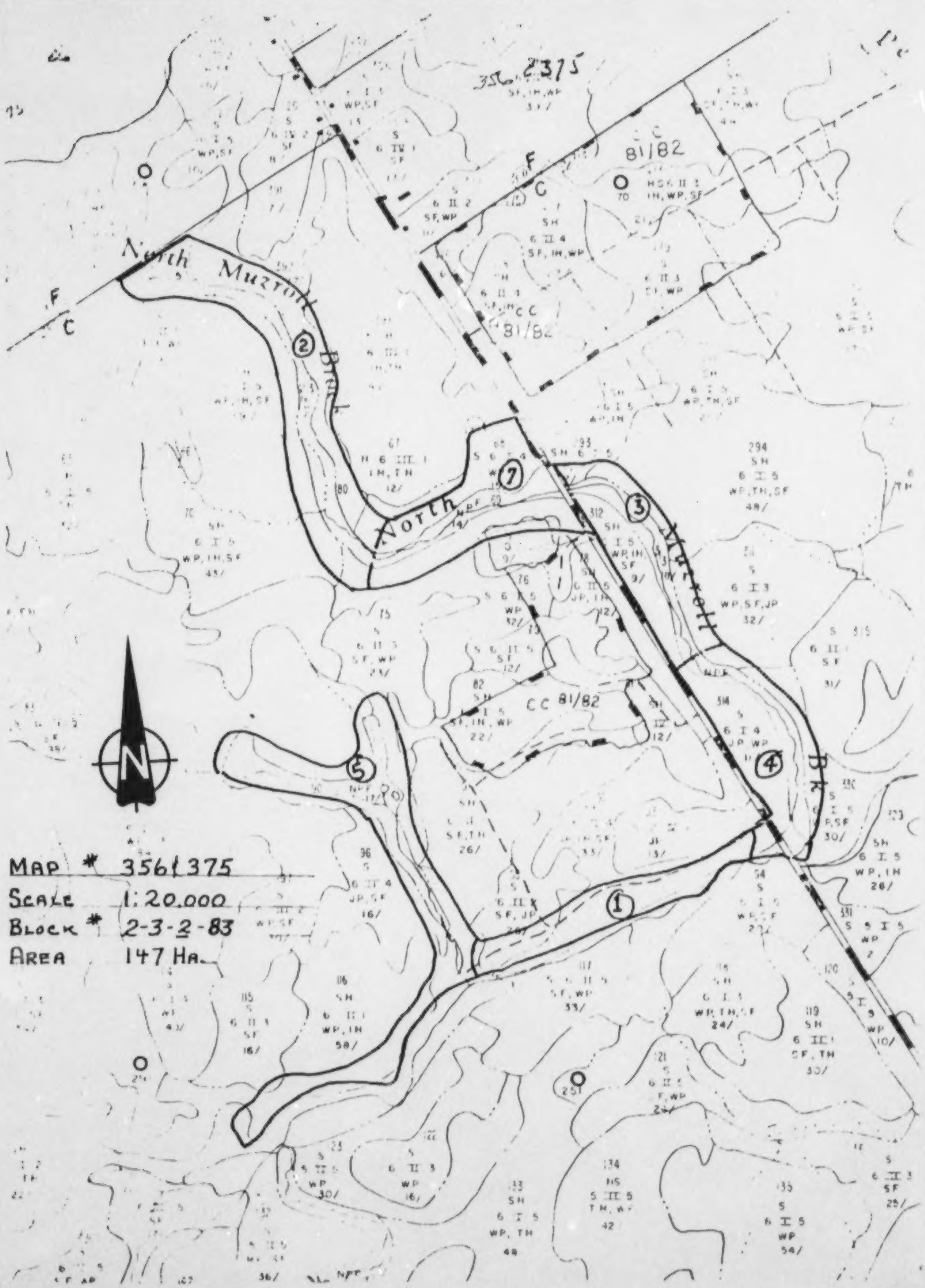
Muzroll Brook (Block No. 203000283)

The cut block application in the operating plan was for a selective cut within the previously established buffer zone along North Branch Muzroll Brook, Muzroll Brook and a tributary. Horses were to be used in the extraction process.

Description: Slope conditions and wood volumes were understandably variable due to the length of the buffer zone involved. Slopes were generally moderate (5-10%) but became steeper immediately adjacent to the stream. An estimate of 74 m^3/ha of softwood volume was derived from the operating plan. Pine (jack and white) was common and the trees appeared to be healthy. There was some evidence of wildlife usage.

Prescription: Selective cut was approved by the Region.

Results: The harvesting operation was underway during most of the cutting season and was occasionally visited. Overall job appeared satisfactory; in places, however, there appeared to have been an excessive amount of wood removed. Operators were warned by Licensee personnel to stop selecting only the high quality wood and leaving the deformed pine and budwormed fir and spruce. Individual tree marking was occasionally necessary to ensure that this did not happen. Based on the scale reports from this operation, 2 095 m^3 of softwood veneer and sawlog material and 616 m^3(st) of softwood pulp were removed. There was no evidence of stream damage.



356 2375
North Muzroll Brook
North Muzroll Br
F
C
CC 81/82
CC 81/82
CC 81/82
①
②
③
④
⑤
⑦
N
NPF

MAP * 356/375
SCALE 1:20,000
BLOCK * 2-3-2-83
AREA 147 HA.

Muzroll Brook (Block No. 203000283)

QUEENS-CHARLOTTE LICENSE - J. D. IRVING, LIMITED (LICENSEE)
RUSSELL AND SWIM LIMITED (SUB-LICENSEE)

Seven sites under this license were examined for potential of experimental buffer zone harvesting. Cutting prescriptions were written for six of these. Experimental harvesting operations were carried out at one of two blocks being harvested directly by the Licensee and at three of four blocks being harvested by the Sub-Licensee. All experimental operations involved selective cuts (three with skidders and one with a porter). The Sub-Licensee indicated an interest in conducting similar operations in upcoming cutting seasons with refinements based on the results of these experimental operations.

Big Hole Lake (Block No. 206001083)

The block referred to herein is located to the northwest of Big Hole Lake.

Description: Original buffer zone width was 100 m. Slope was 0-5%. Wood volume was good and was estimated to be 177 m^3/ha (taken from operating plan). This consisted of large spruce, fir and hemlock. There was some evidence of wildlife usage of the buffer zone. This was a trail-cut operation.

Prescription: The 0-50 m zone was to be an exclusion zone with no harvesting allowed. In the 50-100 m zone a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was to take place. The Sub-Licensee agreed to attempt to use a porter in the retrieval of wood from the buffer zone. All unmerchantable trees were to remain standing.

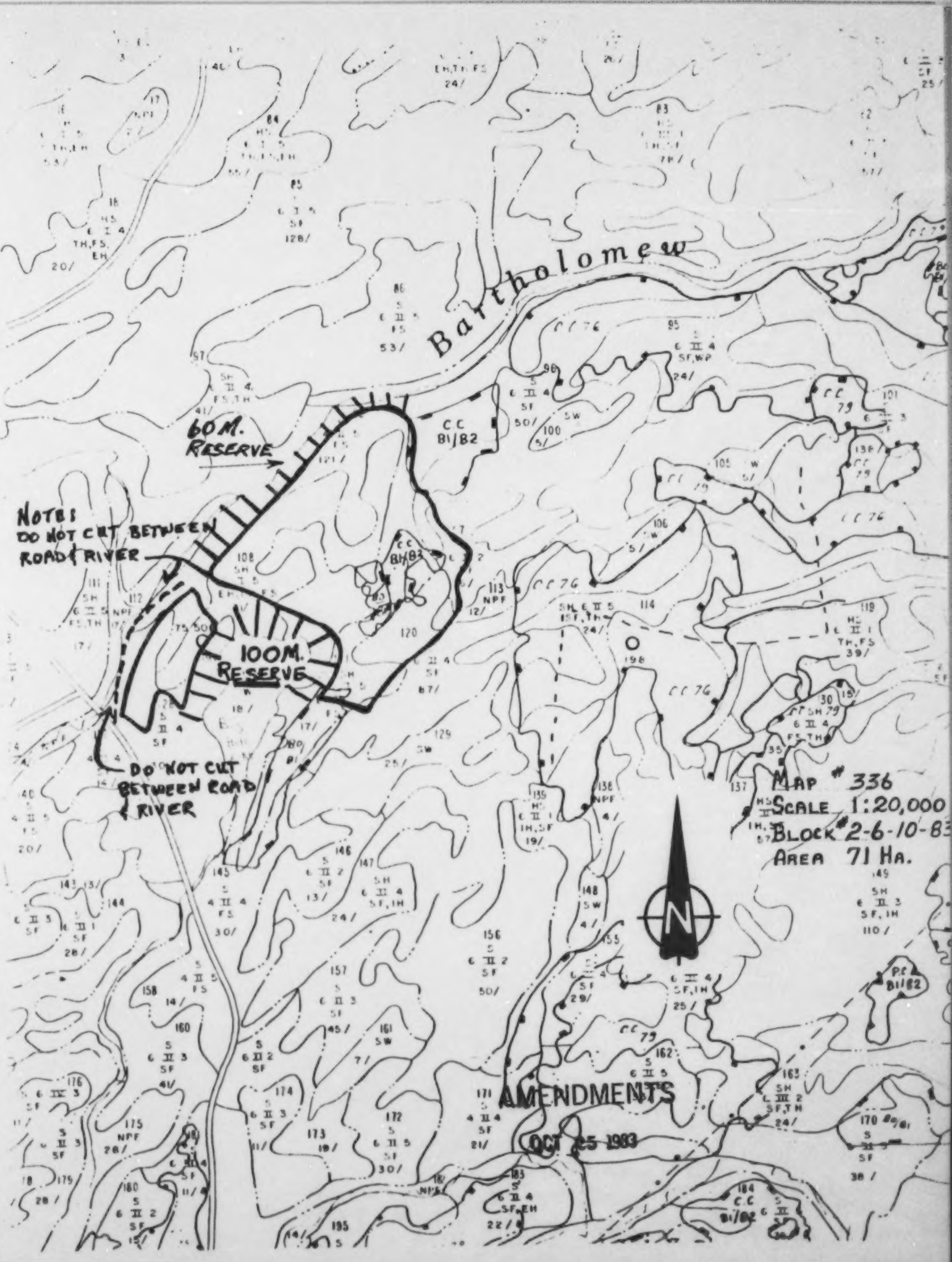
Preparatory Work: The 50-100 m zone was to be cruised to determine volumes and species composition. Flagging was to be placed at 50 m from the lake shore to delineate the exclusion zone and at 100 m from the lake shore to delineate the selective cut zone.

Results: Cruising and flagging of the 50 m line were carried out by Regional personnel. An estimate of 190.2 m^3/ha of softwood was derived from the cruise. Sub-Licensee personnel flagged the 100 m line. To give the porter greater maneuverability, clearcut strips (approximately 6 to 9 m in width and 40 m apart) were allowed in the 50-100 m zone.

Selective harvesting in the buffer zone was carried out from approximately the middle to the end of August. Several cutters were involved in felling the trees (the centerline of each cutter's "strip" was delineated by one of the clearcut strips) while only one porter operator collected the wood. This operation was visited several times due to its uniqueness. It appeared to go very well; there was little damage to the residual vegetation. The porter operator was very careful and utilized the clearcut strips well in picking up wood. Maneuvering time was obviously increased but this was at least partially compensated for by the volume of sawlog material being delivered to roadside. The slash produced from the felled and limbed trees provided a cushion effect, thus reducing the amount of ground disturbance created by the porter.

The main factor in the success of this selective cut utilizing a porter was the relatively high proportion of large diameter trees and subsequent "openness" created (enabling greater porter maneuverability) by the selective cut. This openness was noted by the Regional Biologist when the site was visited on November 8. Other than this he was pleased with the operation. Two trees had been cut and limbed, but were not bucked and had been left on the ground. Approximately six trees had blown down by November 8. On December 14 the site was reexamined following severe winds in the area and approximately three dozen trees had now blown down. This was largely concentrated in the northern portion of the buffer zone and appeared to have created a "domino" effect. All trees in the 0-50 m zone were still standing.

The local foreman was very pleased with the selective cut and estimated that 140 m^3 of softwood had been removed.


Bartholomew
60M. RESERVE
100M. RESERVE
NOTES: DO NOT CUT BETWEEN ROAD & RIVER
DO NOT CUT BETWEEN ROAD & RIVER
MAP # 336
SCALE 1:20,000
BLOCK # 2-6-10-83
AREA 71 HA.
N
AMENDMENTS
OCT 25 1983
CC B1/B2
CC 76
CC 79
PC B1/B2
NPF
SW
108
113
114
119
120
129
137
138
139
145
146
147
148
149
155
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183
184
195
198

Big Hole Lake (Block No. 206001083)

South Branch Renous River (Block No. 206013683)

Description: Original buffer zone width was 100 m. Slope was 0-5%. Tree species and volumes were variable throughout the buffer zone; there was a mixture of fir and spruce having an approximate volume of 107-149 m^3/ha. Hardwood species, particularly maple, were common. The fir was relatively large and generally appeared to be over-mature. Patches of alder were common in the eastern portion of the zone. The area was interspersed with game trails.

Prescription: The 0-15 m zone was to be an exclusion zone with no harvesting allowed. In the 15-100 m zone a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was to take place in this skidder tree-length operation. Skidtrails were to be kept to a minimum and all unmerchantable trees were to be left standing.

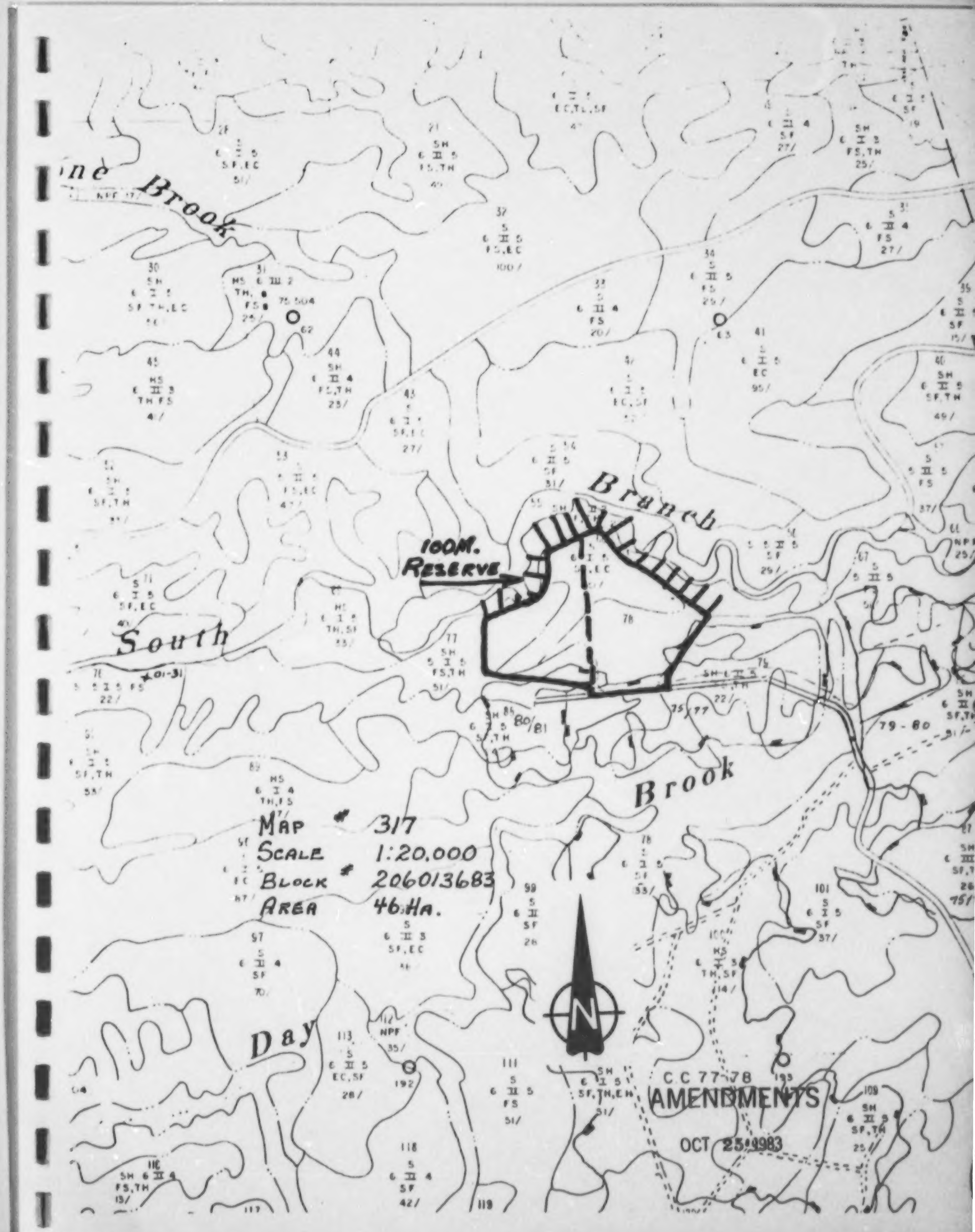
Preparatory Work: The 15-100 m zone was to be cruised to determine volumes and species composition. Flagging was to be placed at 15 m from the river bank to delineate the exclusion zone and at 100 m to delineate the selective cut zone.

Results: Cruising and flagging of the 15 m line were carried out by Regional personnel. A very high total softwood volume estimate of 182.7 m^3/ha was obtained from this cruise. Sub-Licensee personnel flagged the 100 m line.

Selective cutting took place here during September and October. The local foreman was pleased with the operation and estimated that 566 m^3 of softwood had been removed. Two crews were utilized in this selective cut (one at each end).

The completed cut was visited on November 8 with the Regional Biologist. The overall cutting operation appeared to be satisfactory. The distribution of residual trees was "patchy" with some open areas and some relatively undisturbed areas. It was felt that such a distribution would be good for wildlife once browse material began coming up in these open areas. There were a few instances where trees within the 0-15 m exclusion zone had been harvested; this may have been partially due to the fact that the flagging delineating the 15 m line was, in places, very hard to see. At one location this 15 m flagging came too close to the river bank, as well. Cutting of undersized trees did not appear to be a problem.

Operations ceased here before the entire block was harvested. Cutters would be returning next season to remove the residual trees, particularly cedar. It was requested that no further harvesting be carried out within the buffer zone. All the cedar, as well as a small block of spruce and fir that was not reached this year, within the buffer zone will thus remain standing.



ne Brook
Branch
100M. RESERVE
South
Brook
Day

MAP # 317
SCALE 1:20,000
BLOCK # 206013683
AREA 46 HA.

C.C 77-78
AMENDMENTS
OCT 25 1983

South Branch Renous River (Block No. 206013683)

Cains River (Block No. 206001783)

The stand referred to herein is designated by an "A" on the attached map and was left over from a 1982 operation.

Description: Original buffer zone width was 150 m. There was a gradual (5-10%) slope to the river. Softwood volume was estimated to be 141 m^3/ha (taken from operating plan) and consisted largely of spruce, fir and white pine. This was a skidder tree-length operation.

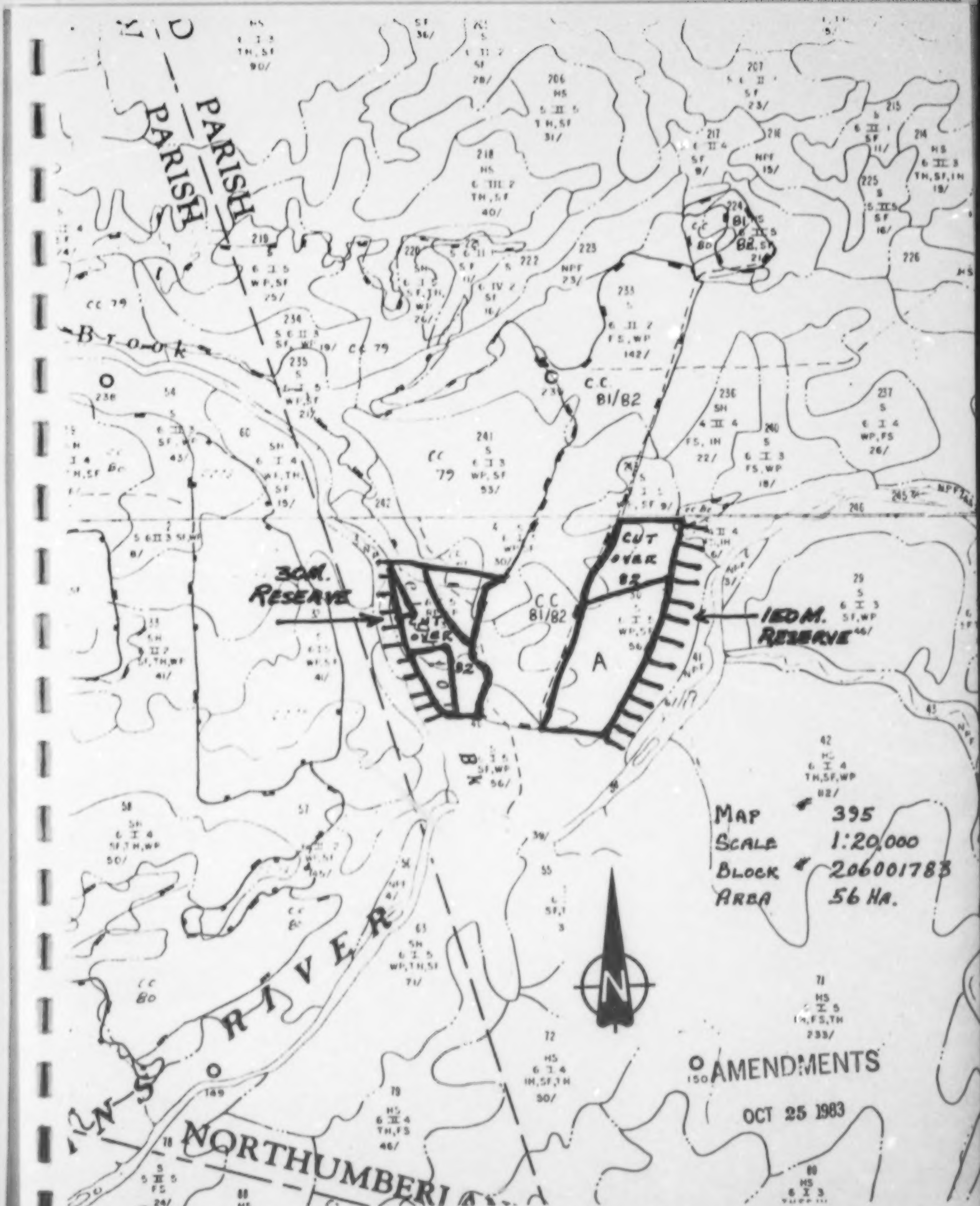
Prescription: The 0-30 m zone was to be an exclusion zone with no harvesting allowed. In the 30-150 m zone a selective cut of all spruce and fir trees 30 cm in diameter and over at the stump and all white pine trees 35 cm in diameter and over at the stump (outside bark) was to take place. All unmerchantable trees were to remain standing. Skidtrails were to be kept to a minimum.

Preparatory Work: The 30-150 m zone was to be cruised to determine volumes and species composition. Flagging was to be placed at 30 m from the river bank to delineate the exclusion zone and at 150 m from the river bank to delineate the selective cut zone.

Results: Cruising was carried out by Regional and Branch personnel. A softwood volume estimate of 137.6 m^3/ha was obtained. Flagging of the 150 m line was accomplished by Sub-Licensee personnel in laying out the cut block while flagging of the 30 m line was carried out by Regional, Sub-Licensee and Branch personnel.

Harvesting of the cut block did not commence until the end of October and it became apparent that the entire block would not be cut this year. However, the Sub-Licensee agreed to harvest a portion of the buffer zone so that a productivity analysis could be carried out. Selective harvesting in the buffer zone commenced near the end of November and operations were terminated for the season approximately two weeks after this. Volumes removed were estimated to be 142 m^3 of sawlog material and 43 m^3(st) of pulpwood.

The portion of the buffer zone which was selectively harvested was visited on December 14. The operation itself appeared to have been carried out satisfactorily. However, the area had really been opened up due to the removal of the large trees, particularly white pine. Blowdown was substantial in these open areas; direction of blowdown was not consistent. The amount of wood removed was undoubtedly a contributing factor to this blowdown. It was felt that, had the entire buffer zone been selectively harvested, a "patchy" distribution would have been realized with some relatively undisturbed areas and some open areas. The portion of the buffer zone which had been selectively harvested was considered to be one of these open areas as it contained a high proportion of large trees.


PARISH
PARISH
Brook
30M. RESERVE
150M. RESERVE
CUT OVER 82
CUT OVER 82
C.C. 81/82
CC 81/82
CC 79
CC 79
CC 80
A
RIVER
NORTHUMBERLA
N

MAP # 395
SCALE 1:20,000
BLOCK # 206001783
AREA 56 HA.

AMENDMENTS

OCT 25 1983

Cains River (Block No. 206001783)

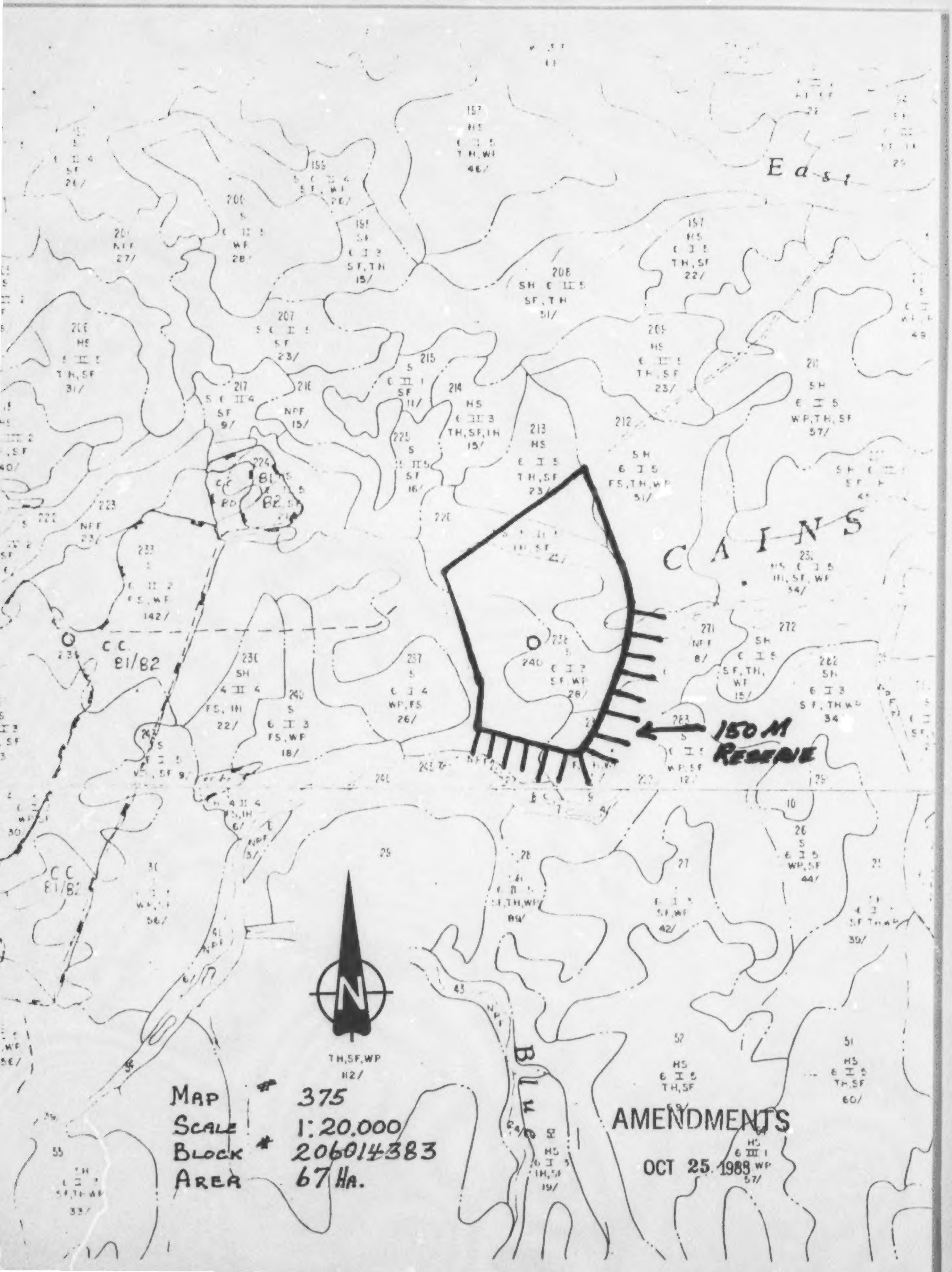
Cains River (Block No. 206014383)

Description: Original buffer zone width was 150 m. Slope was variable; there was a 10-15% gradual slope in the downstream portion of the buffer zone, a steep bank midway along the buffer zone adjacent to the river and a gradual slope (approximately 10%) to the river in the upstream portion of the zone. Softwood volume was approximately 113 m^3/ha (taken from operating plan). Stand structure was generally mixed hardwood and softwood with large spruce and white pine. Most of the area was to be selectively cut (skidder and/or horse tree-length operation).

Prescription: The 0-30 m zone was to be an exclusion zone with no harvesting allowed. In the 30-150 m zone a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was to take place. All unmerchantable trees were to remain standing and any machinery was to use a pre-established road network as much as possible.

Preparatory Work: The 30-150 m zone was to be cruised to determine volumes and species composition. Flagging was to be placed at 30 m from the river bank to delineate the exclusion zone at 150 m to delineate the selective cut zone.

Results: The Sub-Licensee indicated that cutting in this block would not commence until late in the season and cutters were not expected to reach the buffer zone this year. As a result, no preparatory work was done. Cutting commenced late in October but was soon terminated for the season.


East
CAINS
150 M
RESERVE
C.C.
81/82
N
BLU

MAP # 375
SCALE 1:20.000
BLOCK # 206014383
AREA 67 HA.

AMENDMENTS
OCT 25 1988

North Branch Little Dungarvon River (Block No. 206051983)

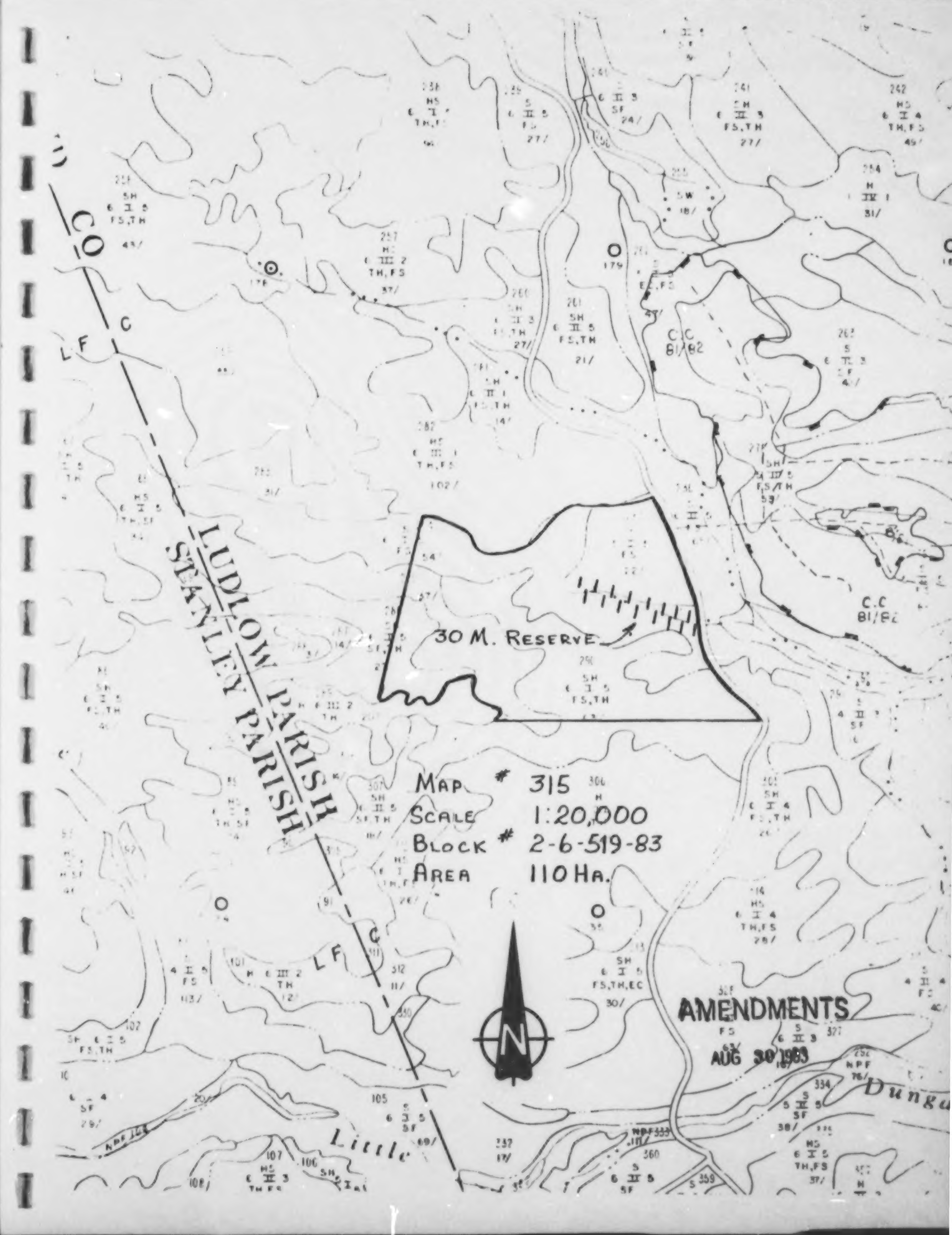
This 30 m buffer zone was examined on August 26 at the request of Licensee personnel to determine if some sawlog material could be removed in this skidder full-tree operation. The cut block was not scheduled to be harvested until 1985 and so was not considered when the search for potential sites was carried out in the spring. Most of the block had been harvested at the time of examination. There were some large softwood trees in this buffer zone. Softwood volume was approximately 154 m^3/ha (taken from operating plan). It was anticipated that blowdown would be a problem as the soil was shallow and rocky and some blowdown was already evident.

A selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was prescribed. All dead (no green needles) softwoods could also be taken. Hardwoods were to remain standing. A small skidder was to be used and damage to residual vegetation minimized. No exclusion zone was specified due to the branchy nature of the stream; no machinery was allowed to cross the stream.

The selective cut started on September 21. A two-man crew, with the smallest skidder on the operation, harvested the buffer zone wood. The Licensee estimated that 332 m^3 of softwood was removed and was pleased with the operation. Due to the blowdown potential the site was visited several times. Some relatively tall, small-diameter fir blew down immediately after the site was opened up; the crew was requested to retrieve this material after the selective cut was finished. It appeared from this operation that full-tree winching might create more damage to residual vegetation, and require that the skidder get closer to the tree to be winched, than tree-length winching. However, less slash would be left in the buffer zone.

There was a severe sedimentation problem upstream from this 30 m buffer zone. The stream extended much further than the map had indicated and a buffer zone was thus only established for the lower portion by the Regional personnel. It is unknown why a pre-cut inspection did not reveal this discrepancy. Without a buffer zone this area was treated similar to the cut block and the stream was repeatedly crossed by skidders. The foreman was asked to rectify this situation by restricting the number of stream crossings and installing logs in the stream at these locations for machinery to cross upon (logs to be removed once operations were finished). This was partially done.

The completed cut was visited in October and November. It appeared to have been well done although the Regional Biologist was surprised by the amount of material which had been removed. Cutting of undersized trees did not appear to be a problem. There was some blowdown but this was not yet substantial and probably consisted largely of trees which would have blown down anyway had the buffer zone remained undisturbed. A high proportion of the residual softwood trees were relatively short and appeared healthy. It is expected that these trees will remain standing. A number of limbs and tops were left in, and around, the stream but this was hard to prevent due to the branchiness of the stream.


LUDLOW PARISH
STANLEY PARISH
CO
LF C
LF C
30 M. RESERVE
C.C 81/82
C.C 81/82
Little
Dunga

Map # 315
Scale 1:20,000
Block # 2-6-519-83
Area 110 Ha.

AMENDMENTS
AUG 30 1983

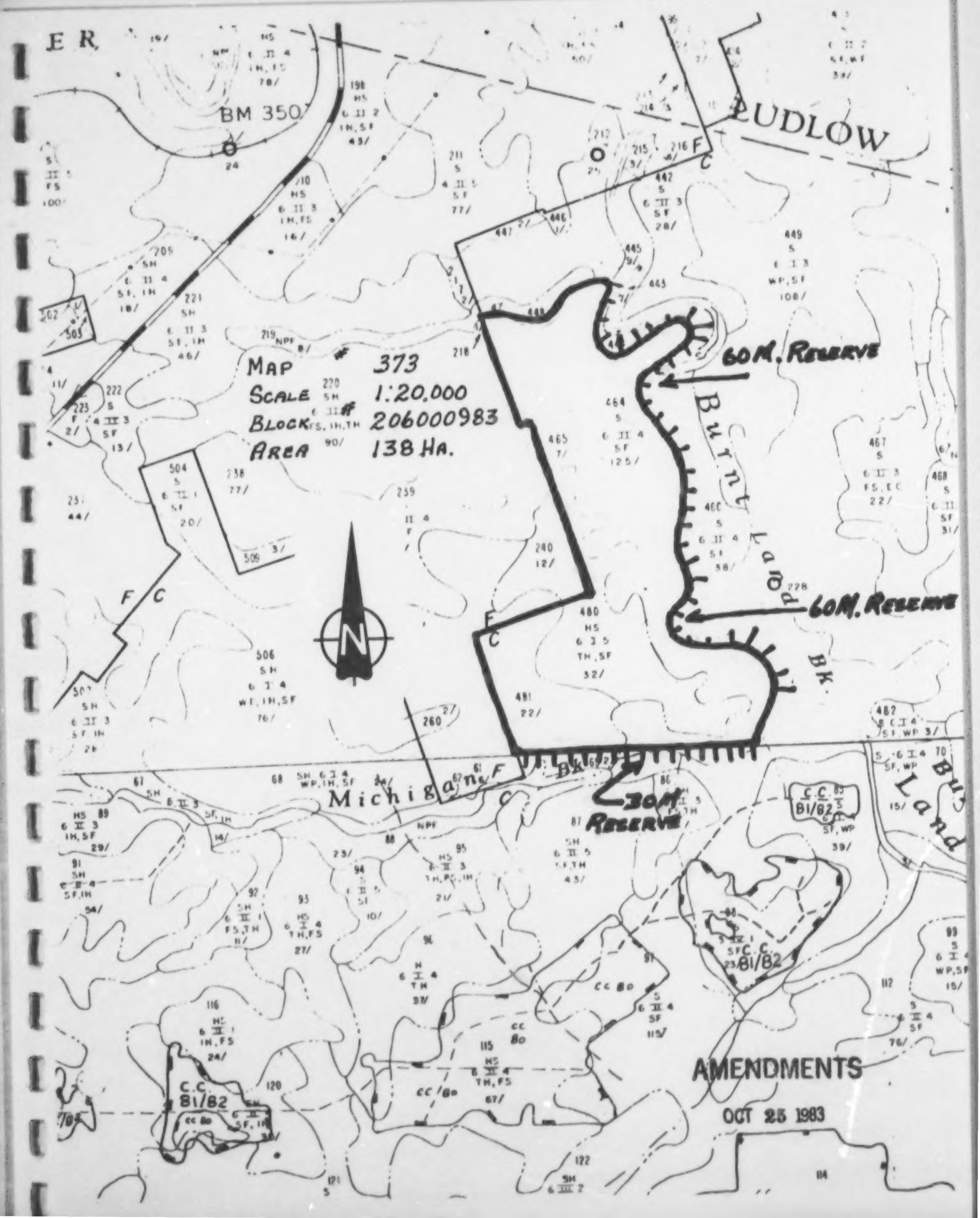
North Branch Little Dungarvon River (Block No. 206051983)

Burnt Land Brook - Michigan Brook (Block Nos. 206000982 & 206000983)

This block was partially harvested in 1982 and reapplied for in 1983. The Burnt Land Brook buffer zone width was specified by Regional personnel to be 100 m in 1982 but this was changed to 60 m in 1983. The Michigan Brook buffer zone width remained at 30 m. Softwood volume was estimated to be 102 m^3/ha (taken from operating plan).

Description: Stand conditions were extremely variable. In the Burnt Land Brook buffer zone spruce predominated in the southern portion while fir became more common further north, followed by a mixture of fir and cedar (in a less well drained area). A steep slope ran along the brook for most of the length of the buffer zone; cutting over the crest of this slope was considered to be economically unfeasible. However, near the centre of the buffer zone this steep slope was not present and it was considered possible to build a trail here down to the brook to extract wood along the base of the slope. In the Michigan Brook buffer zone spruce and fir predominated. Slope varied from 0% to greater than 10%.

Prescription: It was suggested that a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) be undertaken. Exclusion zones of 0-30 m and 0-15 m were to be enforced for the Burnt Land and Michigan Brook buffer zones, respectively. Licensee personnel indicated that Branch or Regional personnel would be notified if they commenced harvesting here and if they were interested in conducting experimental buffer zone harvesting operations. Notification was never received, presumably due to one of the above-mentioned reasons.


MAP # 373
SCALE 1:20,000
BLOCK # 206000983
AREA 138 HA.
60M. RESERVE
60M. RESERVE
30M RESERVE
LUDLOW
Burnt Land Bk.
Michigans Bk
Burnt Land
BM 350
N
F C
C.C. 81/82
CC 80
AMENDMENTS
OCT 25 1983

West Burnt Land Brook and Tributary (Block No. 206012883)

Description: Original buffer zone widths were 60 m along West Burnt Land Brook and 30 m along the tributary. Slope was 0-5%. Wood volume was estimated at 83 m^3/ha of softwood (taken from operating plan). Predominant tree species in the buffer zones were black spruce, tamarack and alder; ground conditions were extremely soft and wet. Wildlife usage, however, appeared to be extensive.

Prescription: Due to the poor ground conditions and wood quality, as well as extensive wildlife usage, it was felt that no experimental harvesting should be carried out in these buffer zones.

FOREST REGION 3

QUEENS-CHARLOTTE LICENSE - J. D. IRVING, LIMITED

Three sites under this license were examined for potential of experimental buffer zone harvesting. Cutting prescriptions were written for all three and operations were carried out in two. These were both selective cuts carried out in association with skidder full-tree operations. The volume of wood removed was unfortunately limited by the poor quality of these buffer zones.

Coal Creek (Block No. 306011683)

Only the 115 ha block labelled as "A" on the attached map was considered for experimental buffer zone harvesting.

Description: Original buffer zone width was 30 m. Slope was 0-5%; the bank associated with the creek consisted of a short but steep slope, the crest of which ran approximately 3-4 m from the edge of the water. Softwood volume was estimated to be 73 m^3/ha (taken from operating plan). Stand structure was open with a lot of blowdown and raspberry. Adjacent cut block appeared to have a higher stocking, but smaller individual tree size, of spruce and fir than did the buffer zone. There was little evidence of wildlife usage; a game trail was seen.

Prescription: The 0-10 m zone was to be an exclusion zone with no harvesting allowed. In the 10-30 m zone a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was to be carried out. This was a skidder full-tree operation.

A small tributary ran through Block A. The slope and stand type along this tributary were similar to that of Coal Creek, although alders were more extensive here. Although no machinery would be allowed to operate within 10 m of this tributary, a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was permitted within this zone.

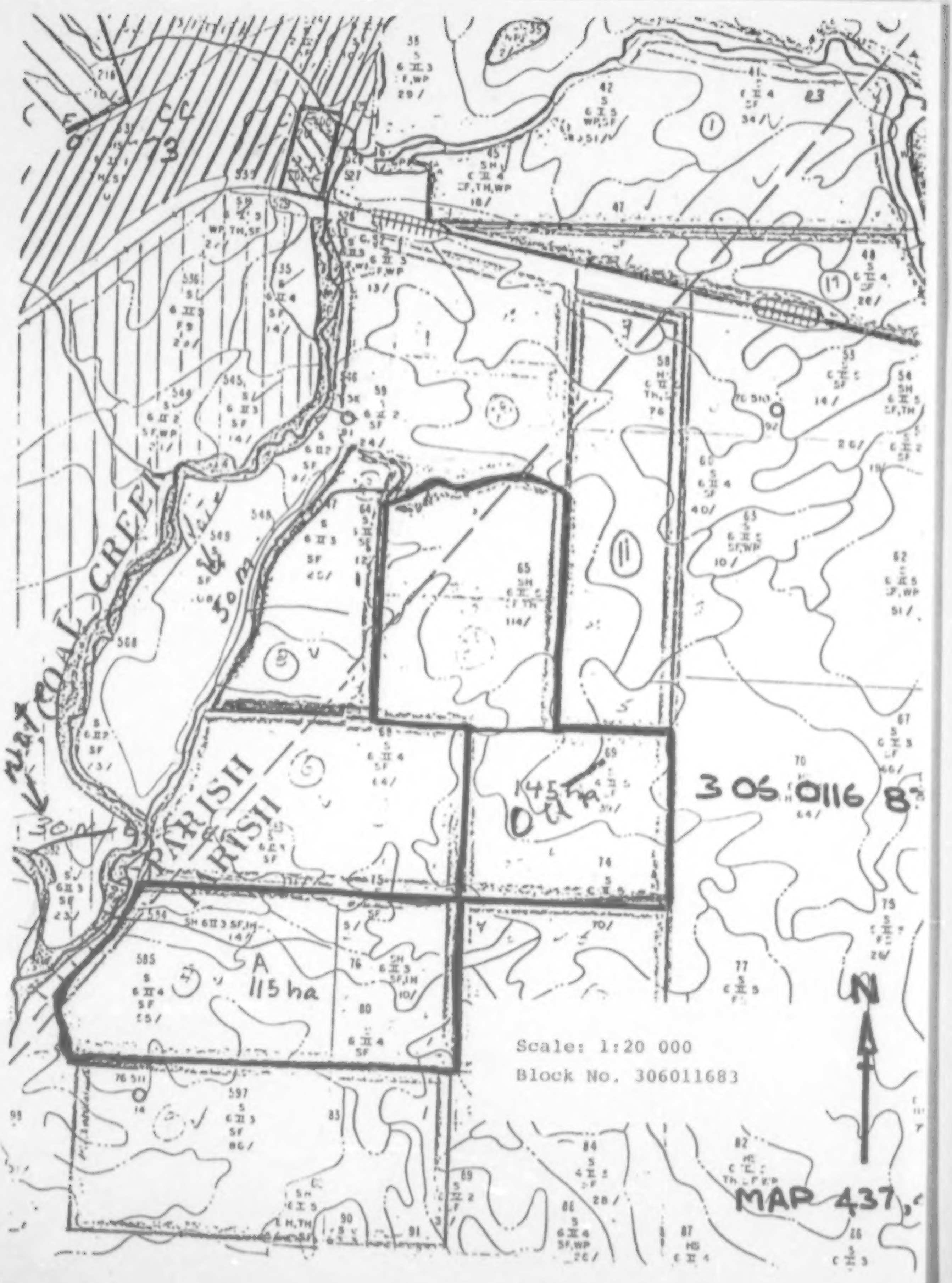
Preparatory Work: The 10-30 m zone was to be cruised to determine volumes and species composition. Flagging was to be placed at 10 m from the stream bank to delineate the exclusion zone and at 30 m to delineate the selective cut zone.

Results: Cruising was carried out by Regional personnel; a softwood volume estimate of 74.0 m^3/ha was obtained. The Licensee was responsible for flagging the 10 m and 30 m lines. However, it was decided by the local foreman that, due to the poor wood quality and "patchiness" of merchantable wood in the buffer zone, it would be better to arbitrarily set the selective cut zone boundary in relation to the preexisting road network and watch the cutters during the selective cut.

Selective cutting took place near the end of October. Although an estimate of the volume removed could not be obtained from the Licensee, the local foreman did indicate that this volume was higher than had been anticipated.

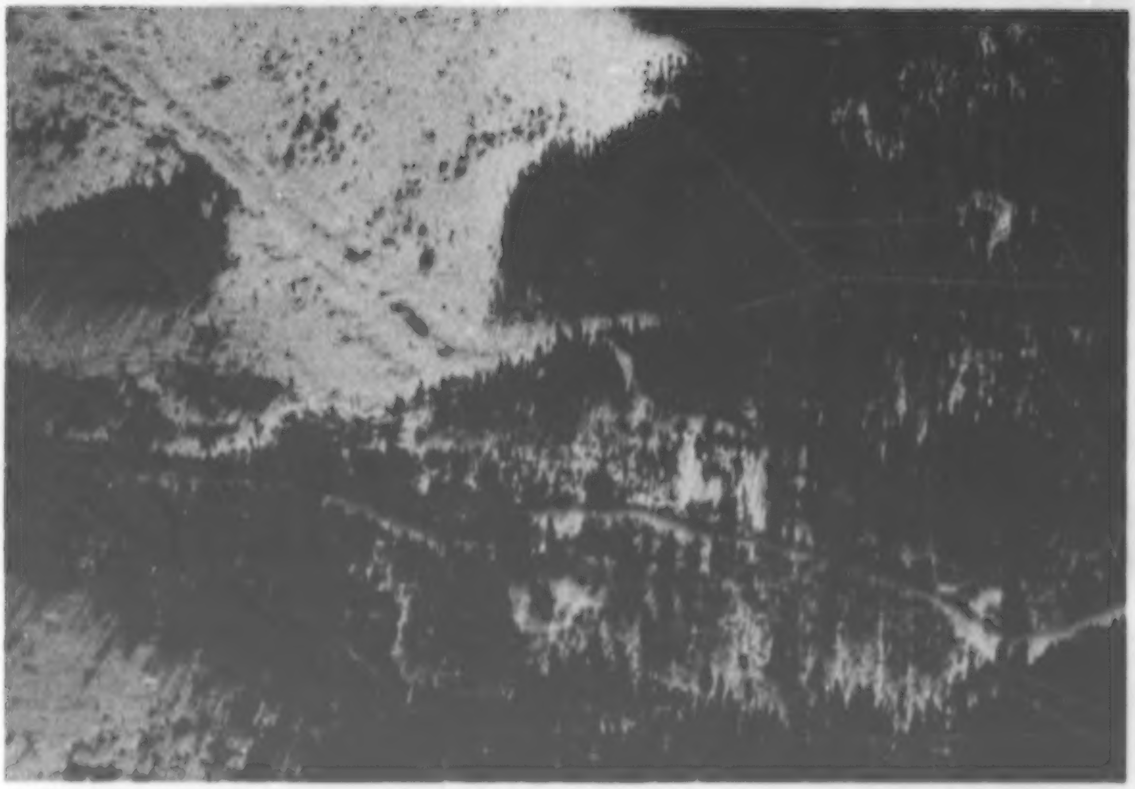
The site was visited on December 19 with the Regional Biologist. It was evident that the southern portion of the cut block near the stream, as well as that portion of the buffer zone, had been undisturbed. The distribution of residual trees in the portion of the buffer zone which had been selectively harvested was patchy, with some relatively open (heavily cut) spots and some which were relatively undisturbed. As previously mentioned, such a distribution should be beneficial to wildlife.

There was no evidence to indicate that undersized trees had been taken; in fact, some residual trees were over the allowable diameter limit, particularly near the portion of the buffer zone which was not harvested. However, a skidtrail was found to have paralleled the stream along most of the harvested portion of the zone and this was within 10 m of the stream bank. Additionally, several trees had been cut within the 10 m exclusion zone. In one instance a tree which was located on the steep bank immediately adjacent to the stream, and which leaned over the water, had been cut. This had to have fallen into the water. Damage to the stream was impossible to ascertain due to the snow and ice present at the time of examination.


COAL CREEK
PARISH
PARISH
145 ha
0 a
A
115 ha
30 m
30 m
306 0116 83
N
MAP 437

Scale: 1:20 000

Block No. 306011683



Coal Creek (Block No. 306011683)

Blackwater Brook (Block No. 306011383)

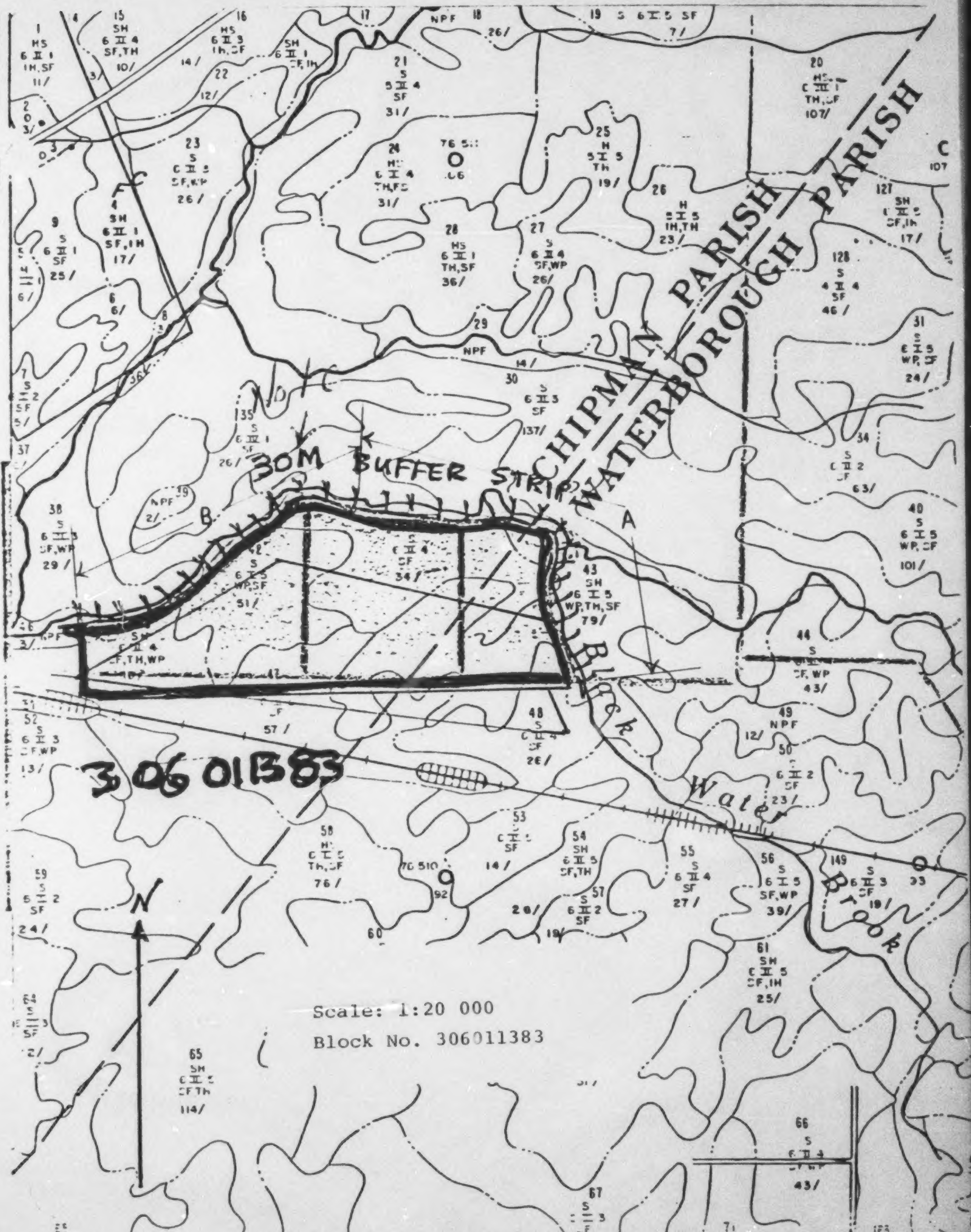
Description: Original buffer zone width was 30 m. Slope was variable along this buffer zone, ranging from 0% to greater than 10%. Wood quality and volume was relatively poor. Softwood volume was estimated to be 85 m^3/ha (taken from operating plan). The zone was separated into two sections, an upstream section (A), which began approximately 200 m upstream from the second road (westernmost road on map, running north-south), and a downstream section (B).

Prescription: In Section A the exclusion zone was to be 0-6 m while a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was to take place in the 6-15 m zone. The 15-30 m zone could be clearcut as part of the normal operation. In Section B the slopes were generally steeper. The 0-15 m zone would be the exclusion zone with no harvesting allowed while a selective cut could take place in the 15-60 m zone. This was a skidder full-tree operation.

Preparatory Work: Flagging of the necessary lines was to be carried out. The selective cut zones were to be cruised to determine volumes and species composition.

Results: Flagging was carried out by Licensee and Branch personnel. The zones to be selectively cut were cruised by Regional personnel. A softwood volume estimate of 84.5 m^3/ha was derived from the cruise. Harvesting took place from mid- to late December. An estimate of the volume removed could not be obtained from the Licensee.

The site was visited on January 23 with the Regional Biologist. Although snow conditions prevented thorough examination of stumps and potential violations it appeared that little material had been removed from the buffer zone. This was undoubtedly a reflection of the overall poor wood quality. This removal was only noticeable in a couple of spots and appeared to have been carried out satisfactorily. It appeared that operations had ceased before portions of the 60 m buffer zone line in Section B were even reached.


CHIPMAN PARISH
WATERBOROUGH PARISH
30M BUFFER STRIP
306011383
Black Water Brook
N
A
B
C
NPF

Scale: 1:20 000
Block No. 306011383

Map 438

Meadow Brook and Tributary (Block No. 306010583)

Description: Original buffer zone width was 30 m. Slope was greater than 10%; the crest of this slope was well defined but varied in distance from the stream. Wood volume consisted primarily of large spruce, fir and pine and was estimated to be 110 m^3/ha (taken from operating plan). This was a skidder full-tree operation.

Prescription: The 0-15 m zone was to be an exclusion zone with no harvesting allowed. In the 15-60 m zone a selective cut of all softwood trees 30 cm and over at the stump (outside bark) could be carried out provided machinery was not operated over the crest of the slope. However, it was felt by the Licensee (and agreed to by Branch and Regional personnel) that the slope was too steep and the crest generally too far away from the brook to make such an operation feasible. As a result, no experimental buffer zone harvesting was carried out here.

FUNDY LICENSE - ROTHESAY PAPER LIMITED

Five sites under this license were examined for potential of experimental buffer zone harvesting and prescriptions were written for all five. Four of these involved selective cuts and/or salvage cuts in buffer zones containing trees of relatively poor health and quality; for one site total removal of merchantable wood up to the stream bank (no exclusion zone) was advocated. These four sites were Haley Brook (Block No. 307002283), Broad River (Block No. 307002383), Riders Brook (Block No. 307003383, [illegible]ged to Block No. 307012183 when approval was given to harvest [illegible] cut block) and Pollet River (Block No. 307002583). The fifth site was Forks Stream (Block Nos. 307012883 and 307012983); this involved the clearcutting of strips into a 200 m wide buffer zone (associated with a deer wintering area). The prescriptions were forwarded to the Licensee in June but considerable confusion existed throughout the cutting season as to when, and if, they would be carried out. The block at Riders Brook was harvested during the summer but Branch personnel and the Regional Biologist were unaware of this operation (due largely to the change in the cut block number); no experimental buffer zone harvesting operations were carried out here. Similarly, no experimental operations were carried out at the Pollet River block, which was harvested in the fall. The major reasons given for not conducting experimental buffer zone harvesting operations in these two blocks were excessive slopes and poor wood quality. The Haley Brook and Broad River blocks were to be harvested by a Sub-Licensee but were cancelled after wood quotas were reached. It was finally determined that the Forks Stream block was scheduled to be harvested in late fall or early winter. However, the Sub-Licensee decided to move into another block first which meant that the Forks Stream block would not be harvested at least until after January, 1984. Monitoring of experimental operations in the buffer zone could not be carried out then due to the upcoming project deadline. It was later learned that this block would not be harvested until the next cutting season.

Thus, due to several confounding factors no experimental operations were carried out under this license in spite of numerous Branch and Regional staff-days spent in the field and correspondence with several Licensee personnel.

FOREST REGION 4

QUEENS-CHARLOTTE LICENSE - J. D. IRVING, LIMITED

Two sites at Victoria Lake were examined for potential of experimental buffer zone harvesting. Due to the small wood volume and for aesthetic reasons it was decided that the 60 m buffer zone of one block (Block No. 406014683) should remain intact. The trees in the buffer zone associated with the second block (Block No. 406014583) appeared larger and less healthy. A selective cut was suggested for this zone.

Victoria Lake (Block No. 406014583)

Description: Original buffer zone width was 60 m. Slope was 0-5%. Softwood volume was estimated to be 89-119 m^3/ha. There were some large trees but both spruce and fir were in relatively poor condition, particularly in the northern half of the buffer zone. Patches of blowdown both within and outside the buffer zone were common.

Prescription: The 0-15 m zone was to be an exclusion zone with no harvesting allowed. In the 15-60 m zone a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was to take place. This diameter limit was to be raised to 35 cm in the stand containing smaller, and seemingly healthier, trees in the southern portion of the buffer zone. All dead trees (no green needles) could be salvaged. This was a skidder full-tree operation.

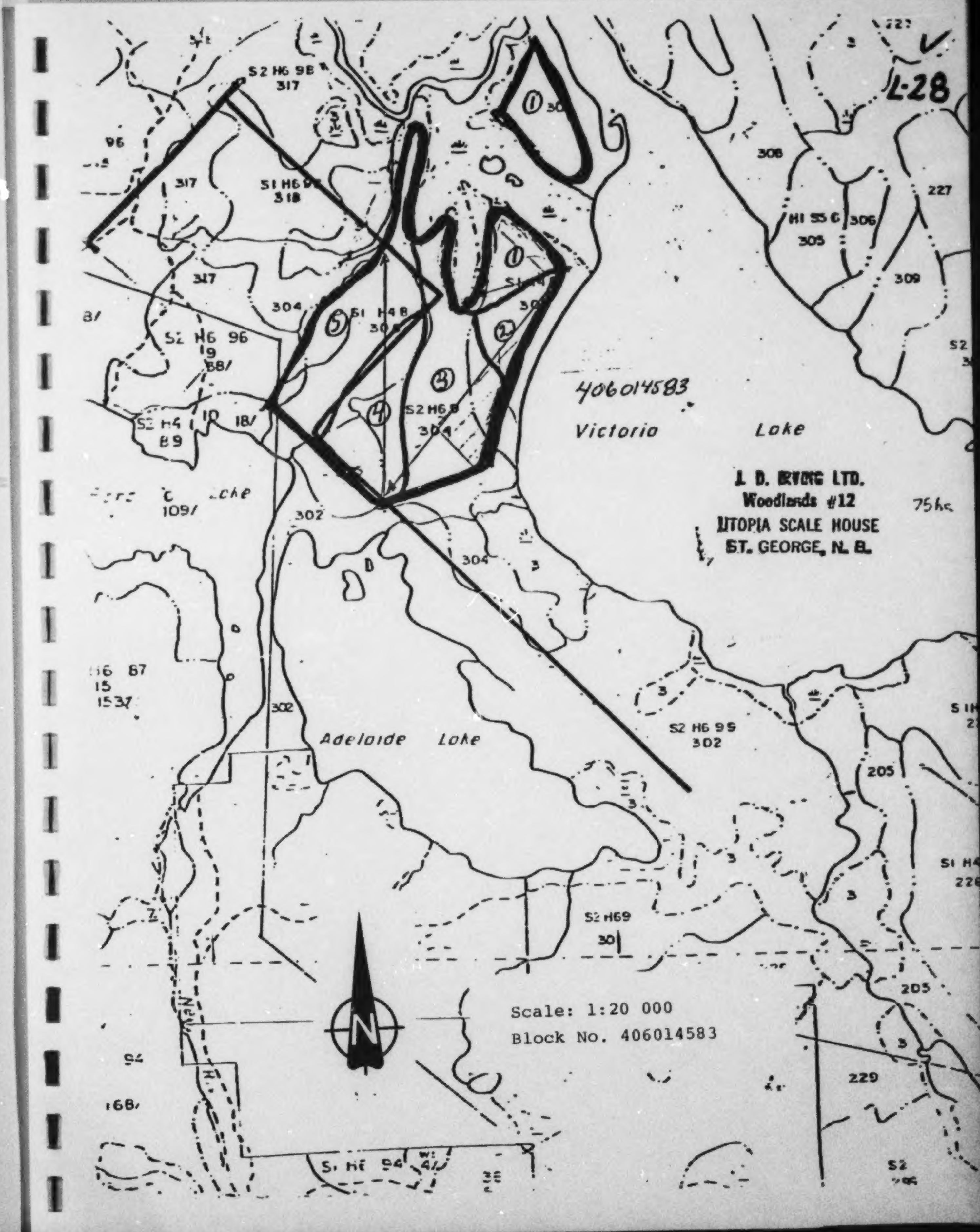
Preparatory Work: The 15-60 m zone was to be cruised to determine volumes and species composition. Flagging was to be placed at 15 m and 60 m from the lakeshore to delineate the exclusion and selective cut zones, respectively. The distance was to be measured from the crest of a small (2-3 m) slope which was immediately adjacent to the lake.

Results: Cruising and flagging were carried out by Regional personnel. It was discovered that the original buffer zone width had been flagged at approximately 100 m, rather than 60 m, from the lakeshore. Because of this, the Regional Biologist decided that the exclusion zone line should be flagged in at 40 m from the shore, allowing a selective cut between 40 and 100 m. The estimate of total softwood volume derived from the cruise was surprisingly low, 74.0 m^3/ha.

Selective cutting took place in mid-August. Approximately 370 m^3 of softwood was removed. In spite of individual tree marking by the local foreman the two-man crew used in this selective cut took practically all standing softwood in approximately the northern two-thirds of the buffer zone. Apparently this crew had difficulty in adjusting from the normal clearcutting operation. The local foreman indicated that he would not have utilized this crew in the specialized cut but Branch personnel carrying out the productivity analysis had already invested time in this crew in the normal cut block. In addition to undersized trees being cut, a few trees inside the 40 m line had been taken and, at one location, the skidder was driven through this exclusion zone to the crest of the slope adjacent to the lake (no trees were harvested here, though).

The area was visited on September 2 with the Regional Biologist. Although the cutters did not follow the prescription, the general consensus was that the buffer zone probably wasn't harmed too badly considering its condition prior to harvesting. This was particularly true for the northern half of the zone where an almost clearcut situation was expected anyway due to the poor wood quality (a lot of dead trees and blowdown) and relatively large diameter of the standing, living trees. The large, residual hardwoods gave a "parklike" appearance to this portion of the zone following the operation. In the southern portion of the zone a much higher proportion of small softwood trees (generally clumped) was left. This was probably due to a greater amount of small trees here, in combination with the 35 cm diameter limit, and a warning given the cutters by the local foreman. It is anticipated that the exclusion zone will receive more wind damage due to the degree of opening created in the selective cut zone.

V.
L-28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S1 H4
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S2 H6 8
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308
H1 55 G
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309
Adelaide Lake
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109/
H6 87
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S2 H6 95
302
205
S2 H69
30|
205
229
S4
168/
S1 H6 94
S1 H4
226
N

406014583

J. D. IRVING LTD.
Woodlands #12
UTOPIA SCALE HOUSE
ST. GEORGE, N. B.

75 ha

Scale: 1:20 000
Block No. 406014583

Victoria Lake (Block No. 406014583)

FUNDY LICENSE - ROTHESAY PAPER LIMITED

Two sites under this license were examined for potential of experimental buffer zone harvesting. Prescriptions were written for each but neither were experimentally harvested.

The 30 m buffer zone along the Tributary of Five Mile Brook (Block No. 407010683) was found to contain badly budwormed fir. Wood volume (largely spruce and fir) was poor and was estimated to be 78 m^3/ha. Slope was greater than 10%. It was prescribed that the 0-10 m zone would be an exclusion zone with no harvesting allowed. Between 10-15 m a selective cut of all softwood trees greater than 20 cm in diameter at the stump (outside bark) could take place and between 15-30 m the normal clearcut operation could take place. The buffer zone along Five Mile Brook (same block number) was considered to be inoperable due to the steepness of the slope. Due to extensive wildlife usage here it was suggested that a 30 m exclusion zone, measured from the crest of this steep slope, be flagged in.

There was no response to this prescription from either the Licensee or the Sub-Licensee involved with this block so it was assumed that they were not interested in conducting experimental operations.

The 60 m buffer zone along Five Mile Brook (Block No. 407010583) contained better wood volume (estimated at 89 m^3/ha) although there were scattered patches of unmerchantable wood and alders. The fir was again in relatively poor condition. Slope was 5-10% along most of the buffer zone. A 0-15 m exclusion zone was prescribed. Strip cuts, 30 m in width and running perpendicular to the stream, were advocated for the 15-60 m zone. These clearcut strips were to be separated by 60 m of undisturbed trees, thus achieving one-third removal.

Correspondence with Licensee personnel on November 16 revealed that the Sub-Licensee cutting this block felt that such an experimental operation would be uneconomical in light of additional road and planning costs and the small volume of wood expected to be removed. He therefore was not interested in such an operation. This reasoning was difficult to understand when one considered that normal cutting operations were being conducted in the block at that time and also the types of experimental operations being carried out economically elsewhere.

YORK LICENSE - ST. ANNE-NACKAWIC PULP AND PAPER COMPANY, LTD.

Two sites under this license were examined for potential of experimental buffer zone harvesting and prescriptions involving strip cuts were formulated for both. As of the end of December neither cut had been completed.

The first site was a 60 m buffer zone along the Shogomoc River (Block No. 408003083) in the Charlie Lake area. A portion of this block had been harvested prior to the current cutting season. Wood volume was estimated to be 149 m^3/ha, with a relatively high proportion of spruce. There were occasional wet areas and large boulders scattered throughout the buffer zone. Slope was 0-5%. A 0-30 m exclusion zone and a 30-60 m alternate strip cut zone was prescribed. These clearcut strips were to be approximately 40 m in width. These were flagged in by Licensee, Regional and Branch personnel in conjunction with the existing 60 m flagging. Cruising of the strip cut zone was carried out by Regional personnel.

Harvesting was commenced in June. However, in early July (before the strips were reached) the cutters decided to leave this block for a while, possibly until after freeze-up. By this time Branch personnel carrying out a productivity analysis had already invested time in the examination of these cutters in the normal cut block. No definite date could be obtained from the Licensee as to when operations would resume here, in spite of repeated attempts to do so. It was learned from Regional personnel in January that cutters had returned to this site and the strips were being harvested. However, no monitoring could be carried out due to the upcoming project deadline.

The second site was a 30 m buffer zone along the West Branch Nackawic River (Block No. 408000483). The slope here was variable. Wood volume was estimated to be 107-149 m^3/ha; trees were generally in poorer shape than at the first site and there was a little blowdown. A strip cut pattern in the 10-30 m zone was laid out by Licensee, Regional and Branch personnel. Strips to be clearcut ranged from 40 to 60 m in width and were located so as to include the largest wood volumes. "Leave" strips ranged from 40 to 240 m in width, depending upon the extent of less merchantable wood. Wood removal in the 10-30 m zone would have been approximately 35%. The 0-10 m zone was to be an exclusion zone with no harvesting allowed.

It was decided by the Licensee during the summer that this block would not be harvested this cutting season as the wood volumes to be obtained from it were no longer required.

CARLETON LICENSE - JUNIPER LUMBER COMPANY LTD.

Two sites under this license were examined for potential of experimental buffer zone harvesting and prescriptions involving selective cuts were formulated for both. Neither of these were experimentally harvested.

The first site was a 60 m buffer zone along McGivney Brook (Block No. 409002483). The slope was 5-10%. Softwood volume was approximately 71 m^3/ha, consisting of large but somewhat scattered trees. A selective cut of all trees 30 cm in diameter and over at the stump (outside bark) was prescribed for the 30-60 m zone. The 0-30 m zone was to be an exclusion zone with no harvesting allowed. A similar selective cut was also allowed within the 15 m buffer zone of a tributary which ran through the block, provided machinery did not cross the tributary. Flagging and cruising were carried out by Licensee and Regional personnel.

Cutting began here during the latter part of August. Valley Forest Products Ltd. had been contracted by this Licensee to conduct the harvesting operation and this company was not interested in selectively harvesting the buffer zone as most of the wood removed would be softwood. Although the Licensee expressed an interest in this project and a desire to obtain additional wood from this buffer zone, it did not or could not persuade Valley Forest Products Ltd. to carry out the selective cut.

The second site was a 60 m buffer zone along Elliott Brook (Block No. 409002083). The slope here was relatively steep, the crest of which was generally well defined throughout the buffer zone. The 60 m flagging was already in place but in one area came closer than 60 m to the stream bank. Wood volume was approximately 119 m^3/ha and largely consisted of spruce and fir. The 0-30 m zone was to be an exclusion zone with no harvesting allowed. In the 30-60 m zone, and where terrain conditions allowed, a selective cut of all softwood trees 30 cm in diameter and over at the stump (outside bark) was prescribed. The original buffer zone line was to be reflagged to ensure that it was 60 m from the stream. Cruising of the 30-60 m zone was carried out by Regional personnel.

No definite word could be obtained from the Licensee as to whether this block would be harvested during the current cutting season or if the selective cut would be attempted. It was learned from Regional personnel in January that harvesting had commenced in this block. This was too late for monitoring of experimental operations even if they were carried out.

FOREST REGION 5

RESTIGOUCHE - TOBIQUE LICENSE - FRASER INC.

Numerous requests to participate in this project were made to this Licensee. However, no experimental buffer zone harvesting projects were established. It was intended that a buffer zone would be selectively harvested under an unemployment insurance (U.I.) job creation harvesting project being carried out by a Sub-Licensee but this buffer zone was not reached prior to termination of the U.I. project.

The major reason for this lack of participation was, according to Licensee personnel, union problems. Operators wanted prohibitively high compensation for conducting any experimental buffer zone harvesting operations, specifically selective cutting. As no subsidies were to be paid, such operations were not considered by the Licensee to be economical. Strip cuts were deemed to be undesirable due to the narrow buffer zones (20-40 m) established in this Region.

Little Forks Branch

This area was part of a deer wintering area and/or travel corridor. It was to be selectively harvested under an unemployment insurance job creation harvesting project proposed by Raoul Couturier Lumber Ltd. The project was terminated before the portion adjacent to the stream was harvested. However, it was felt that the technique used here would be generally applicable to buffer zone harvesting, particularly on steeper slopes. A brief summary of the project was therefore considered worthwhile.

The slope was greater than 10%. Wood volume was approximately 149-179 m^3/ha, consisting largely of spruce and fir. Stand structure was variable; in some sections a variety of size classes was evident while in others the size was relatively uniform.

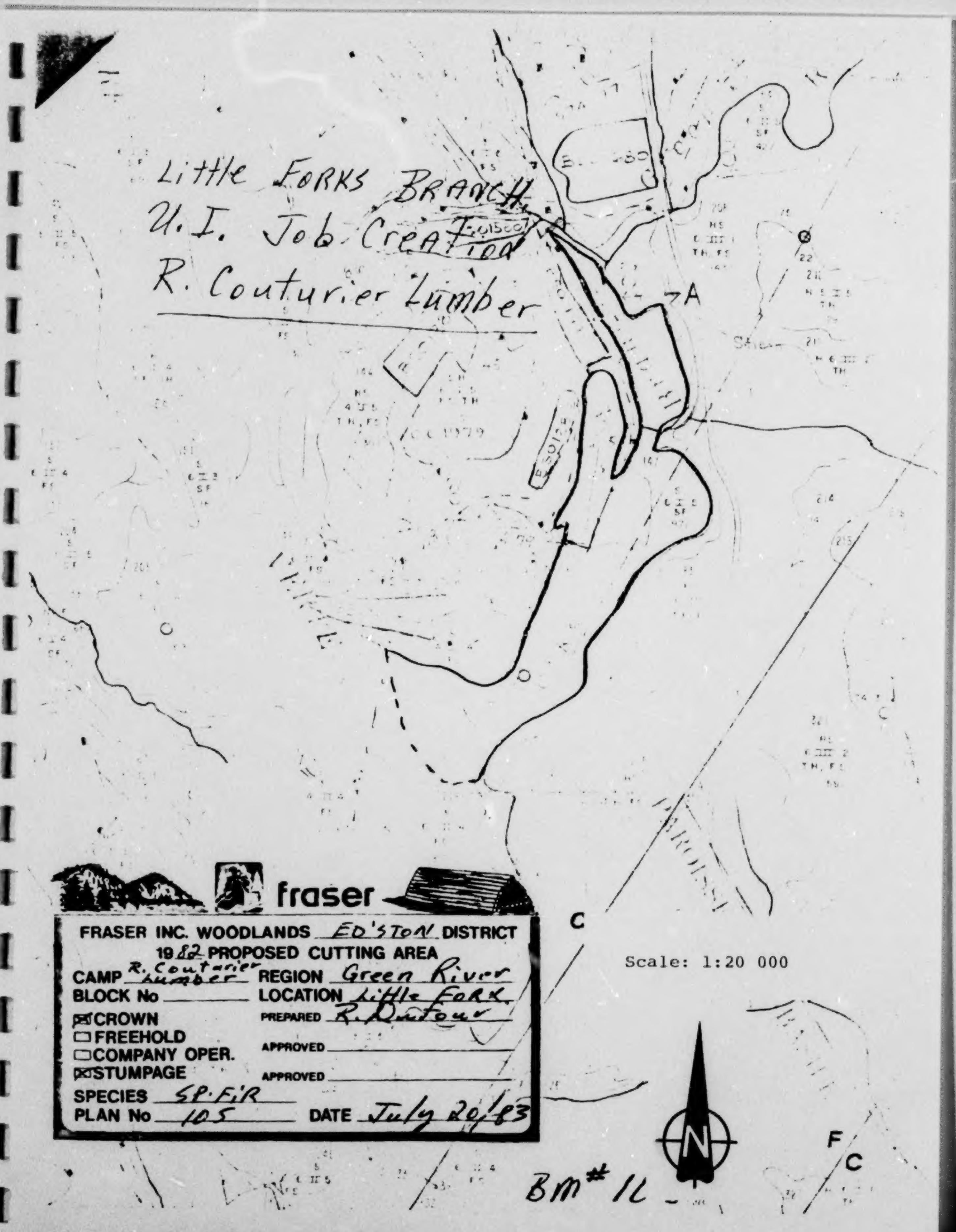
Conditions of the selective cut were specified by the Region. The volume extracted was to be largely comprised of dead and dying trees with a small percentage of living trees; essentially a salvage operation. It is the opinion of Branch personnel that some of the tall, non-limby spruce could have been included in the allowable harvest without harming the quality of the deer wintering area. This inclusion would certainly have increased the economic viability of this operation.

Skidder trails approximately 9 m in width, and roughly perpendicular to the main road and landing network, were established at 90-120 m intervals. Felled trees were limbed and then winched to these trails utilizing a radio-controlled portable winch, a farm tractor with a mounted winch and a bombardier with a mounted winch. The wood on each trail was then hauled up the slope to a landing (roadside) by a skidder. Normally only one of these three machines was operated on each trail and the skidder travelled from trail to trail picking up wood.

Selective harvesting began in early August and continued for eight weeks. A total of 847 m^3(st) of pulpwood and 283 m^3 of sawlog material was removed. The Sub-Licensee indicated that the amount of sawlog material removed was less than expected due to the poor condition of the majority of the harvested trees.

The completed site was visited on December 6. Overall stand structure and composition had been relatively undisturbed. There were a few relatively open patches, one of which contained two or three leaning trees. However, blowdown should be minimal. Deer usage of the area was extensive.

Little Forks Branch
U.I. Job Creation
R. Couturier Lumber



fraser

FRASER INC. WOODLANDS ED'STON **DISTRICT**
1982 **PROPOSED CUTTING AREA**
CAMP R. Couturier Lumber **REGION** Green River
BLOCK No ________ **LOCATION** Little Fork.
☒ **CROWN** **PREPARED** R. Dufour
☐ **FREEHOLD**
☐ **COMPANY OPER.** **APPROVED** ________
☒ **STUMPAGE** **APPROVED** ________
SPECIES SP.FIR
PLAN No 105 **DATE** July 20/83

Scale: 1:20 000

BM# 12

DISCUSSION and CONCLUSIONS

It is unfortunate that experimental buffer zone harvesting was not more widespread and uniformly distributed among the various Licensees of this province. However, it appears from those operations which were carried out that removal of wood from buffer zones can be accomplished in an economically and "environmentally" sound manner. Potential harm to the water ecosystem was normally negated by the establishment of an exclusion zone immediately adjacent to the watercourse, as well as a general reluctance by operators to harvest trees on steep (greater than 10%) slopes (reducing the chance of overland sediment flow). Immediate and long-term effects on the wildlife and aesthetic resources were more difficult, and in some cases impossible, to ascertain. Future land use patterns (e.g. mosaic of cut and uncut blocks, height and type of regeneration in cut blocks), governed by a number of factors, will exert considerable influence over the long-term effects.

A number of factors critical to the successful completion of any such experimental operations can be delineated. Appropriate buffer zones and prescriptions must be chosen. Wider buffer zones have a much greater potential for experimental harvesting, particularly if slopes are not excessive. More wood can be removed, thereby increasing the economic justification for alteration or specialization of the particular cutting technique, and greater flexibility in prescription formulation is possible. This was undoubtedly an important factor in the success of this project in Region 2, which consistently had wider original buffer zones. It appeared that the volumes of available merchantable wood in narrow buffer zones often did not provide enough incentive for Licensees to proceed with specialized operations. However, the selective removal of a few large trees from narrow buffer zones, often accomplished without machinery entering the zone, appeared to be operationally feasible. As previously discussed, each prescription must be tailored to the type of operation and machinery being utilized in the adjacent cut block. Additionally, sufficient time must be allowed for any necessary adjustments in the layout of the cut block or the road and skidtrail design. Experimental operations must be adequately supervised to ensure that the prescriptions are followed.

This project was a learning process and, as such, mistakes were made both in the formulation and carrying out of prescriptions. However, these mistakes were considered for the most part to be minimal. Blowdown is an obvious concern wherever there is partial stand removal and it is imperative that monitoring of blowdown continue at these sites. It appears that better orientation of residual strips may have reduced the amount of blowdown in some cases (e.g. Tributary of the Little South Branch of the Big Sevogle River) although overall site quality may have prevented any improvement in this situation. Blowdown generally appeared to be more common at selectively harvested sites which had sustained a fairly heavy, uniform degree of removal, although there was considerable local variation. Sites having a patchy distribution, with some open areas and some relatively undisturbed areas, seemed to be less susceptible to blowdown. A certain amount of blowdown should be expected regardless of the type of operation and amount of planning. However, proper recognition of those sites having severe blowdown potential (poor quality or health of trees, shallow soil, etc.), followed by either no removal or total removal, is critical.

The strips and open areas created in buffer zones during these experimental operations are expected to benefit herbivorous mammals which utilize these zones, provided the residual protective cover remains intact. Strip widths were variable depending on the Licensee and type of machine involved. Strips created in trail-cut operations ranged from 20 to 30.5 m in width, depending on the normal trail-cut width utilized by the particular Licensee.

The current management and establishment of watercourse buffer zones was found to be extremely variable between Forest Regions. This was undoubtedly a reflection of the diversity of attitudes among D.N.R. and Licensee personnel regarding the value of buffer zones. This attitude diversity was at least partially responsible for the varying degrees of participation in this project. Considerable effort was expended in an attempt to achieve unanimous participation although success in this regard must be regarded as minimal. It was apparent that some operators were not concerned about obtaining additional wood volumes. The scheduling of cutting operations was often unreliable. The value of buffer zones to the fisheries resource, and more particularly to wildlife and aesthetics, was generally not well accepted by operators. It is obvious that better communication is needed among and between D.N.R. and Licensee personnel if multiple use management of buffer zones is to become a reality. Additionally, greater emphasis must be placed on non-wood fiber resources.

APPENDIX I

The majority of the experimental buffer zone harvesting operations carried out during this project involved some form of selective or strip cutting. Volumes removed, costs involved and immediate effects could be assessed relatively easily but any long-term effects were much harder to define. It became apparent that examination of sites subjected to similar operations in past years, and for which reasonably accurate documentation existed, might provide valuable insight into the outcome of experimental harvesting operations conducted during the 1983 cutting season. Sites were examined in Forest Regions 1 and 5 and involved only those specialized cutting practices that took place in what could be considered to be watercourse buffer zones. No formal baseline of data had been collected at most of these sites prior to experimental operations and harvesting information was, in some cases, lacking. The analysis thus had to be subjective and involved the condition of residual or adjacent stands, amount and type of regeneration and any other pertinent features. The following is a summary of these findings.

Preliminary information on some of the deer wintering area harvesting projects was presented in a previous report (New Brunswick Deer Yard Management Projects: A Summary, N.B.D.N.R., 1979) and was therefore not included here.

For the purposes of this Appendix the word "poplar" refers not only to balsam poplar but also to the aspens. Any numbers or letters in brackets after the name of an area signify the cut block number in that particular year and are intended for easy reference if further information is desired.

A preliminary observation common to most of the sites having clearcut patches or strips was that natural hardwood and softwood regeneration were more plentiful in the vicinity of trees (cedar, hardwood, unmerchantable species, etc.) left standing in these cleared areas. It appeared that the shading effect created by these residual trees was more favourable for establishment of most types of natural regeneration. Strips or patches having residual trees normally contained a greater diversity of regeneration at varying heights while those without residual trees were initially predominated by raspberry and beaked hazelnut. However, the future stocking of merchantable species would likely be more uniform at these latter sites.

Unless otherwise indicated, there was no record or evidence of damage to the watercourses involved. This was undoubtedly a function of the normal establishment of an exclusion zone immediately adjacent to each watercourse.

FOREST REGION 1

Forty Mile Brook

In 1977 approximately six strips, averaging 18 m in length and 6-9 m in width, were clearcut into the buffer zone along Forty Mile Brook. The purpose of these strips was to improve beaver habitat by providing an increase in the amount of poplar adjacent to the brook. The buffer zone was predominated by softwood species, largely spruce and fir.

The strips were found to contain beaked hazelnut, raspberry, dogwood, mountain maple and a few mountain ash, but no poplar. It was concluded that no benefits to beaver populations were realized here. It was noted that poplar was relatively abundant in the normal clearcut block, causing speculation that the clearcut strips in this predominately softwood buffer zone were not wide enough to provide conditions conducive to the growth of poplar.

Forty-Four Mile Brook (D34, D28)

In 1982 a selective cut of sawlog material was carried out in the buffer zone along Forty-Four Mile Brook and a tributary, using a skidder tree-length system (D34). A total of 1 734 m^3 of spruce and fir sawlogs and 284 m^3 of pulpwood were removed over a 25 ha area. The operation appeared to have been carried out satisfactorily although some felled, merchantable trees had been left on the ground. Copious amounts of hardwood browse were growing in the openings that had been created. A few trees, particularly fir, had blown down. Skidtrails did not appear to pose a sedimentation problem. It was apparent that an exclusion zone (15-30 m in width) had been left throughout most of the selectively cut area.

Another selective cut took place at the head of this brook (D28) in 1979, again using a skidder tree-length system. However, this was poorly done. It was essentially a clearcut operation around the middle portion of the buffer, while removal at either end was less than anticipated. According to Regional personnel, sedimentation and debris in the stream was a problem here. Hardwood regeneration and raspberry now appear to predominate in the openings created.

South Branch Middle River Deer Wintering Area (E224-225)

In 1978 clearcut strips were created in this deer wintering area. The purpose of these strips was to provide browse for deer. Approximately 21 ha were clearcut and both skidder tree-length and porter trail-cut operations were used. Wood volume was estimated to be 126 m^3/ha, consisting largely of spruce and fir with some hardwood.

Five strips, ranging in width from 40 to 60 m, were examined. Blowdown around the edges of these strips was minimal to non-existent. Four of these strips had been scarified and planted (two with jack pine and two with spruce) during the year following the cutting operation. Burning had occurred on the two strips planted with spruce. No silvicultural treatment was carried out in the fifth strip.

Predominant species in the four planted strips were raspberry, fireweed, beaked hazelnut and grasses. These were extremely dense and appeared to be impeding the growth of the planted softwood trees which were, for the most part, alive but showed little evidence of growth. It was speculated that silvicultural treatment may have released nutrients (e.g. nitrogen) which promoted the proliferation of at least some of these unmerchantable species. There was little evidence of natural softwood or hardwood regeneration. A patch of aspen (approximately 4 m in height) was evident in one of these strips; it was adjacent to a stand of aspen in the residual block at the edge of the strip and appeared to have been produced either by seeding in or by suckering from stumps in the clearcut strip.

The unplanted strip was very different. Ample hardwood regeneration (maple, alder, poplar, red osier dogwood) was present at varying heights. Raspberry and beaked hazelnut were much less evident. Spruce and fir trees were also present but stocking was not uniform. Wildlife usage of this strip was extensive.

It was noted that the residual stands of mature softwood around these clearcut strips contained a dense understory of browsing material such as mountain maple, beaked hazelnut and red osier dogwood. This situation was considered ideal for a deer wintering area; any openings created in the overstory due to blowdown would allow some of this material to reach a height beneficial to deer under deep snow conditions.

As previously mentioned, the purpose of the strips was also to provide browse; this has not yet been realized except in the untreated strip. Based on the density of the predominant species in the treated strips, this situation is not likely to change in the near future.

Nine Mile Brook Selective Cut

A selective cut was undertaken in a portion of a previous established buffer zone along Nine Mile Brook in 1974 and 1975. Contractors utilized a skidder tree-length system to remove mature wood. Spruce and fir were the predominant species removed. The volumes removed ranged from 26 to 42% of the original volumes. The volume left was estimated to average 112 m^3/ha. Costs were variable depending on site conditions, wood quality and experience of the crew.

Due to time constraints it was impossible to examine all of this relatively long selective cut area. The portions examined appeared to have had minimal disturbance. There was good interspersion of softwood patches and small openings. These openings generally contained copious amounts of both hardwood and softwood regeneration. Wildlife usage of the area was extensive.

Another selective cut (SI-2, SI-3) took place in the 60 m buffer zone along this brook near Lovalls Lake in 1976. It was again a skidder tree-length operation. A total of 300 m^3 of softwood was removed over a 5.5 ha area.

This site was similar to the previous selective cut site along Nine Mile Brook in that wood removal appeared to be minimal. Ample browse was interspersed among the residual cedar and spruce.

It should be noted that Regional personnel concluded from these selective cuts that at least a waiving of stumpage charges was necessary to provide enough incentive to operators to conduct such operations. Blowdown did not appear to be a problem at either site.

Pabineau Number Two Brook (B018)

In 1973 and 1974 strips were cut into a portion of a deer wintering area to create browse for overwintering deer. Both skidders and porters were utilized. A total of 965 m^3 of softwood and 149 m^3 of hardwood were estimated to have been removed. Strips were of two basic widths; the narrow strips averaged 8 m in width while the wider strips averaged 40 m in width. Length was variable. Strips were cut in a northwest direction from a previously established road. No silvicultural treatment was carried out.

There was a noticeable lack of browse in the narrow strips; softwood regeneration was often more common than hardwood regeneration. This appeared to have been a result of a lack of sunlight, particularly as the strips were located on a basically north-facing slope. Red maple, birch, poplar and beaked hazelnut regeneration was much more common in the wider strips while fir, spruce, cedar and hemlock predominated along the perimeter of these strips. Wildlife utilization of these wider strips was good. Moose appeared to be more common than deer, which was reportedly not the case in previous years. Blowdown was minimal.

Forty Mile Brook (E069)

In 1977 four strips were clearcut into a deer wintering area in conjunction with a normal skidder, tree-length operation. The total area of these strips, ranging from 120 to 360 m in length and 20 to 60 m in width, was approximately 5 ha. Total softwood (spruce and fir) and hardwood (maple and birch) volumes were estimated to be 97 m^3/ha and 100 m^3/ha, respectively. Three of the four strips were burned, scarified and planted in black spruce. Scarification took place perpendicular to the contour. The fourth strip, the narrowest, received no silvicultural treatment and was not planted.

Blowdown was found to be minimal around the periphery of these strips. Predominant species in the three treated strips were grasses, fireweed and raspberry. These formed a dense mat over the planted softwood trees. One knoll of young poplar was seen. A few residual cedar had been left standing in the strips as well. Some wildlife activity was found but this was not as substantial as that seen in the narrow, untreated strip. Raspberry was abundant here in addition to several hardwood browse species.

Taylor Brook (B41A)

In 1978 a clearcut operation was allowed to take place to the edge of a pond and the headwaters associated with this watercourse. It was hoped that such an operation would benefit beaver populations. The stands that were harvested were primarily mixedwood. No silvicultural activity was carried out.

The site was found to contain large amounts of browse material, specifically beaked hazelnut, red osier dogwood, poplar and birch. Moose and deer utilization of the area was extensive and browsing pressure was rated as extreme. There was as yet no increase in usage of the area by beavers as their preferred hardwood species were still in the immature stage. Some softwood regeneration, largely fir, was detected.

Little-Middle River Deer Wintering Area (E054)

Patches were cut within this deer wintering area between 1978 and 1981 as part of an ongoing, long-term management project. These ranged from 1.6 to 17.8 ha in size. Total area harvested was approximately 207 ha and an estimated 20 405 m^3 of softwood and 8 648 m^3 of hardwood were removed; this included a selective cut which took place in the periphery of some of the patches in 1980. Patches were interspersed throughout the wintering area (some occurring close to streams), the aim being to provide browse and establish a rotation of softwood stands. All the patches proposed in the overall plan had not yet been harvested.

Amount and height of regeneration in these patches was variable as harvesting had taken place in different years. Regeneration was not particularly abundant. Common species were mountain maple, raspberry, cherry, red maple and sugar maple. Both red and sugar maple stump sprouts were particularly evident in one 1979 patch. Softwood regeneration was spotty and consisted largely of fir. Blowdown around the perimeter of these patches was not excessive.

According to Regional personnel, deer have utilized these patches during the winter, particularly the ones having some cedar left standing and those having had selective cuts around their perimeters. Deer usage of these patches should increase once regeneration becomes more abundant and higher.

FOREST REGION 5

Thibodeau and Halfway Brooks

Strips were harvested close to these brooks in 1976 and 1977 in conjunction with a deer wintering area project. These strips were examined in 1978 and were found to contain large amounts of pin cherry, raspberry and poplar. Maple and birch were also common, particularly in the smaller patches. Little blowdown was seen. Examination in 1983 revealed a similar pattern, except that some of the browse material now appeared to be too high to be useful for deer. Raspberry was not as evident while softwood regeneration was more evident. Blowdown was still minimal. There was moderate deer usage of these strips.

PART II

Cost and Production Analysis of Timber Harvesting Within Watercourse Buffer Zones

Stephen Henley

INTRODUCTION

The effects on fish and wildlife of harvesting wood within watercourse buffer zones were of extreme importance, and were given considerable attention before and after harvesting during this project. The primary concern in cuts of this nature must always be the biological ramifications, which will be evaluated before harvesting takes place. Assuming that some buffer zones can be harvested successfully without detriment to local fish and wildlife populations, the economics of such operations becomes the key issue.

A production analysis of harvesting operations conducted within buffer zones was initiated in conjunction with a study of the biological effects of this type of cutting. The main objective of this analysis was to determine if wood could be removed from buffer zones at a cost competitive with those incurred during normal harvesting operations. The effect of buffer zone stand and terrain characteristics, various cutting techniques, and extra travel distance on production were also of interest.

These objectives may have been met by employing one harvesting crew to work at a number of different sites during the study. This approach could have made comparison of the relationship between site variables and productivity more straightforward, but would have limited the analysis to one harvesting system and introduced biases. Hence the general approach of the analysis was to conduct the studies at a number of different cutting sites evaluating productivity of the crews already working there. This method thus incorporated different harvesting systems, crews and techniques, while at the same time covering a range of stand types.

At this point of the report, readers should consider that several terms are used interchangeably to refer to the section of watercourse buffer zones where harvesting took place. The terms buffer and experimental have been used in conjunction with zone, area, cut, and block to denote the harvested part of the watercourse buffer zone where evaluations were carried out. This area usually occurred immediately adjacent to what is referred to as the control zone, block, cut or area. These terms describe the normal or regular harvesting operations where control data was obtained. Machine utilization is defined as the productive hours divided by the scheduled hours on an operation, and availability as the time that a machine was mechanically available for work divided by the scheduled time.

At each location, data collection was conducted on the operations in the regular cutting area to supply control data, and in the buffer zone to supply the experimental data. In order to be able to compare the rates of production from the control and experimental zones, a measure of productivity in terms of solid volume per productive hour had to be obtained for each area and each component of the harvesting system. This objective was met by defining the different elements of each component's work cycle, and then timing that component of the system at work for a number of days in both the control and experimental areas, with the overall cycle times broken down into time elements. For example, the work cycle for a skidder was defined as being comprised of travel in, positioning, choking, travel out, decking, mechanical delays and non-mechanical delays, and during each cycle elemental times would be recorded. During timing or at the end of the shift the wood volume produced was scaled, and the wood size based on scale is quoted in the production summary tables of this report.

With data obtained from this field work the productivity in terms of solid volume per productive machine-hour (pmh) was obtained for each control and buffer area. This information is compared and discussed in this report in conjunction with the corresponding operations description for each area. The mechanical availability and utilization are also quoted for each system component, but care should be taken in the interpretation of these two pieces of information. The time studies on which this information is based were of short duration, and the availability and utilization figures do not represent long term averages. Further points covered in the results and evaluation section of this report are the effects on production of cutting prescriptions in the buffer zones, and extra travel distance. Theoretical fixed and operating costs based on production data are presented.

Before proceeding to the operations description and analysis section of this report, some observations concerning the participation of various Licensees regarding the production analysis part of this report need to be mentioned. Since the Departmental field crew could not always be in direct contact with foremen on upcoming study areas, the Licensee management personnel agreed to act as liaisons to supply information regarding dates when control and buffer zone cutting would commence. They also agreed to inform their field foremen of the Department's intention to observe and time the operations. The field foremen, in turn, were to inform the workers and equipment operators of these plans. In many instances, this line of communication was not established or maintained by the Licensees. This resulted in wasted time and effort, and a loss of data. On two operations, after assurances that buffer zones would be cut, the buffer zones were abandoned after considerable time (20 person.days) and expense had been invested by the Department. If future arrangements regarding the supply of information and completion of work on the part of Licensees are to be carried out by the Department, better accountability and co-operation on the part of Licensees must be ensured.

HARVESTING OPERATIONS

GENERAL DESCRIPTION

During the course of the project, a total of eight cutting operations were studied which included conventional cut and skid operations, trail-cuts with forwarders, one mechanical operation, and a salvage cut of a deer wintering area using small winches, a farm tractor with a winch, and an all-terrain vehicle with a winch. The latter case did not include a study of a control area but was still evaluated due to its proximity to a stream and to assess the productivity and suitability of the system for similar operations in the future. It had been hoped more sites with a wider range of stand and terrain conditions and harvesting systems could have been studied, but time and logistics prevented this.

Production rates in control and experimental zones were affected by a number of factors. Buffer zones varied in width from one location to another according to the slope adjacent to the watercourse and the degree of protection deemed to be required by the fish and wildlife populations. In some cases, orientation of the cut blocks and shapes of the buffer zones resulted in shorter forwarding distances from buffer zones to landings, than the distance from control zone study areas to the same landings. The cuts either involved strip cutting in the buffer zone, or diameter limit selective cutting. The results that incorporate these various factors have provided a cross-section of circumstances that can be expected in future operations. These results indicate that partial harvesting of buffer zones can be done at costs close to those incurred during the harvesting of adjacent blocks.

To better explain and qualify the results, individual descriptions and results for the operations are presented. In each case, the harvesting system was only evaluated from the stump to roadside and did not include any mechanical processing that may have been used at roadside (e.g. in full-tree systems). Processing functions were neglected because the effect of wood removal from buffer zones on their production would have been minimal.

Terrain condition descriptions are based on criteria found in the booklet, Terrain Classification For Canadian Forestry, developed by the Forest Engineering Research Institute of Canada in conjunction with the Logging Operations Group of the Canadian Pulp and Paper Association.

DESCRIPTION AND EVALUATION OF OPERATIONS

Mechanical System

Block Number One

This cutting operation was the only one evaluated where a mechanical system was employed from stump to mill. The field work centred on the productivity of a Koehring Feller Forwarder (KFF) operating on a large clearcut block and a small buffer zone nearby. The KFF, equipped with a multiple-tree shear felling head, cut and forwarded full-trees to roadside where mechanical delimbers and slashers processed the wood prior to transport to the mill.

The forest in this region was comprised mainly of spruce (*Picea spp*.) and balsam fir (*Abies balsamea* (L.) Mill) with a negligible amount of intolerant hardwoods also present. The block was a dense, well stocked, even-aged mixture of mature spruce-fir, with the balsam fir accounting for 60% of the softwood component. Defoliation due to spruce budworm infestation was moderate to severe for the spruce and severe for the balsam fir. These conditions prevailed in both the control and experimental areas.

The terrain conditions were also similar for the two study areas. Slopes were gradual with predominately rolling terrain. Ground strength was adequate in the buffer zone and slightly better in the control zone.Ground roughness had a minimal effect on operations productivity. Table 1 summarizes the stand and terrain conditions present at this site. It shows that operating conditions were very similar for the two zones except that the average tree size was larger in the buffer zone, perhaps due to better growing conditions.

Harvesting in the control area was done in a method typical of most KFF operations. The machine travelled empty to the back of the cut about 300 m from the road, turned, and began cutting a swath back to the landing. The machine cut toward the road right-of-way until it had a full load and could then travel a short distance to unload at roadside and begin another cycle.

Buffer zone cutting was not as straightforward. The buffer area was 60 to 70 m deep and harvesting was allowed to within 20 m of the stream. However, only strips approximately two swaths wide (i.e. two passes of the KFF), separated by untouched strips of equal width, were

Table 1. Stand and terrain conditions summary for block number one.

Site Factor	Control Zone	Buffer Zone
Ground Strength	2	2+
Ground Roughness	2	2
Slope	1	1
Merchantable Volume (m^3)/ha	181.3	170.9
Unmerchantable Volume (m^3)/ha	1.4	0.0
Merchantable Stems/ha	1479	919
Unmerchantable Stems/ha	33	0
Merchantable Tree Volume (m^3)	0.12	0.19

allowed to be cut. The operator was also given permission to remove trees in the adjacent uncut strips that could be reached with the felling head, provided they appeared to be of sawlog size and quality.

Analysis of the data from this experimental cut showed that the productivity of the KFF was only 1.9% less in the buffer zone than in the control area. Table 2 is a summary of the production and operating variables that have been derived from the study, and shows that two factors contributed to the relatively high rate of production in the buffer zone.

The average volume per tree was higher in the buffer zone than in the control zone and the total travel distance required per cycle was lower in the buffer zone. Tree size influenced the volume produced per pmh since the rate of trees cut was low in the buffer zone due to the need for increased manoeuvring in the strip. This is seen in Table 2 where both manoeuvring and the travel loaded elements of the productive cycle were adversely affected by the machine operating in the confines of the strip. Larger trees helped to negate these effects. The shorter travel distance also contributed favourably to the production rate in the experimental area. This buffer zone was not approached from the back face of the clearcut control area but from another road. If the KFF had to travel the average 295 m to the back of the clearcut (Table 2), cut the strips into the buffer, and then travel the same distance back to the landing, production in the buffer zone would have been about 11% less than in the control zone. With the extra distance and

Table 2. Production summary of KFF full-tree system - block number one.

Variable	Control Zone	Buffer Zone
Availability (%)	100.0	91.2
Utilization (%)	98.3	88.9
Productivity (m^3/pmh)	25.0	24.5
Stems/pmh	203	132
Stems/cycle	286	188
Volume (m^3)/cycle	35.2	34.9
Volume (m^3)/stem	0.12	0.19
Travel Empty Distance (m)	295	135
Travel Loaded Distance (m)	84	150
Production Cycle (Minutes)		
Travel Empty	4.40	2.65
Manoeuvre in Stand	0.34	4.53
Felling, Loading Position	72.80	65.85
Travel Loaded	3.89	9.05
Maneouvre at Landing	1.86	2.56
Unloading	1.27	0.77
Total	84.56	85.41

the lower tree volume from the control area, and assuming the same number of stems processed per hour in the buffer, productivity would drop 34 percent relative to the control zone. In practice, this figure would overestimate the loss because the stems/pmh would rise a certain amount as tree size fell.

Since other stand and terrain factors were roughly equal (Table 1), they don't appear to have had an effect on the change in productivity.

Trail-Cut System

Block Number Two

The first of the two trail-cut operations evaluated used an eight-ton Timberjack 230 Forwarder to forward wood from the trails. One cutter worked on each trail, which averaged 40 m in width, and cut, delimbed and piled 2.44 m pulpwood and veneer logs. The forwarder transported each of these separately in the control area, but together in the buffer zone since the veneer content was low in the buffer zone.

The block was comprised mainly of mature, even-aged spruce and balsam fir although a small proportion (4.6%) of total volume was eastern white pine (Pinus strobus L.). The area was quite dense but stocking was variable in both the control and buffer areas. Budworm damage was moderate to severe for the spruce and generally severe for the balsam fir in both areas. The buffer zone was more heavily damaged in general.

Terrain characteristics were fairly uniform throughout the control area with only minor problems resulting from ground roughness. The experimental zone was similar except that slopes were greater and restricted the movement of the forwarder on occasion. Ground strength was good everywhere. Table 3 is a summary of stand and terrain conditions for block number two. It shows that the major difference between the control and experimental areas was the merchantable wood per hectare, with most of the unmerchantable stems in the buffer zone being dead spruce and fir.

Table 3. Stand and terrain conditions summary for block number two.

Site Factor	Control Zone	Buffer Zone
Ground Strength	2	2
Ground Roughness	2	2
Slope	1	2
Merchantable Volume (m^3)/ha	131.1	107.7
Unmerchantable Volume (m^3)/ha	15.9	23.0
Merchantable Stems/ha	1147	769
Unmerchantable Stems/ha	115	183
Merchantable Tree Volume (m^3)	0.11	0.14

Results of the production analysis are summarized in Table 4 and include the rates for two cutters as well as the forwarder. The cutting prescription for the buffer zone was to extend every other trail from the control area into the buffer zone 50 m creating an alternate strip cut. Besides showing the actual rates for the regular cut and the strips, the productivity and other variables are quoted (in brackets) for an average forwarding distance equal to half the depth of the cut from the road to the edge of the buffer zone. Changes to the production rates are based on travel speeds, including speeds by buffer zone travel, and are calculated for the half way distance, since production at this point in the block would theoretically represent an average for the block. The time needed and distance travelled for loading and manoeuvring remain the same.

Based on the information in Table 4, it can be seen that production was different in the two areas for a number of reasons. Veneer

Table 4. Production summary of Timberjack 230 Forwarder trail-cut - block number two.

Variable	Control Zone		Buffer Zone	
Timberjack 230 Forwarder				
Availability %	100		100	
Utilization %	90.3	(89.2)	85.6	(83.6)
Productivity (m^3/pmh)	14.1	(16.0)	12.7	(14.8)
Volume (m^3)/cycle	9.1		7.0	
Loading Distance (m)	130		57	
Travel Empty + Travel Loaded Distance (m)	428	(210)	435	(210)
Veneer:% Total Volume	18.9		1.75	
Production cycle (Minutes)				
Travel Empty	4.34	(2.11)	3.16	(1.51)
Load and Manoeuvre	20.19		13.42	
Travel Loaded	4.23	(2.08)	5.84	(2.80)
Unload	9.69		10.79	
Total	38.45	(34.07)	33.21	(28.52)
Cutters	#1	#2	#1	#2
Availability %	87.4	95.3	92.0	94.1
Utilization %	79.8	79.9	88.1	84.5
Productivity (m^3/pmh)	2.5	1.4	2.6	1.6
Volume/bolt (m^3)	0.03	0.01	0.02	0.02
Bolts/pmh	75.4	115.6	158.8	95.8

logs were forwarded as separate loads in the control area and together with the pulpwood in the buffer area. This caused the loading time and distance to be appreciably higher in the control zone since the veneer was not stacked but left where it was bucked (i.e. density of veneer logs on the ground was less than the density of pulpwood). With the small amount of veneer in the buffer zone transported with the pulpwood, the veneer had to be sorted separately at the landing during unloading and resulted in higher unloading times than for loads from the control block. The adjusted production figures reveal that the overall travel speed was faster for the buffer loads (which were smaller), and on this basis the productivity in the buffer zone is closer to that of the control zone. Actual buffer productivity was 10% lower than the control rate and 21% lower than the adjusted control rate.

Stand conditions affected the operations to a degree. Information in Table 3 shows a higher volume per tree in the buffer zone than in the control zone. However cruise information shows buffer zone tree size distribution to be lacking in the veneer size trees, with a considerable volume just below veneer size. The control area had many veneer size trees and proportionately more pulpwood size trees than the buffer area. Hence the need for separate veneer loads in the control block but not the buffer strip. Terrain conditions in the buffer strip did not differ much from the control and their effect on productivity was minimal.

The cutter information indicates that Cutter #1 was perhaps in a pocket of large wood when timed in the control area since the average bolt size was three times the size for Cutter #2, and double the size of the buffer zone wood. Nonetheless, neither cutter seemed to be affected by increased ground roughness or slope. In fact both managed to produce at a faster rate in the buffer. However Cutter #1 obviously had to work harder in the buffer zone, in view of the lower bolt size, to obtain a higher production rate.

Block Number Three

The second trail-cut operation to be evaluated also used a Timberjack 230 (eight ton) Forwarder to forward wood to roadside. The system was run the same as in block two except that pulpwood and sawlogs were sorted rather than pulpwood and veneer. Instead of strips cut into the buffer zone, the decision was made to attempt a selective cut of all merchantable trees 30 cm (outside bark) and over at the stump for 50 m into the buffer zone.

The block was uneven-aged mixed stand of softwood and hardwood that had been selectively cut in the past. Spruce and fir accounted for the most volume with eastern hemlock (Tsuga canadensis (L.) Carr.), white birch (Betula papyrifera Marsh.), and red maple (Acer rubrum L.) making up the balance. Of the latter three, only half of the hemlock was harvested, while none of the hardwoods were. Budworm damage was moderate. The total volume per hectare was slightly higher in the buffer zone as was the merchantable softwood content, but due to the prescription the volume intended for selective cutting was much lower. This amount is shown in parenthesis in Table 5 along with the actual cruise information.

The terrain conditions presented little difficulty for the forwarder and were the same in the control and experimental areas. These are summarized in Table 5 with the cruise information.

The success of using the forwarder in a selective cut prescription hinged on its ability to manoeuvre amongst the standing trees. Although care was required, the loading function took about the same

Table 5. Stand and terrain conditions summary for block number three.

Site Factor	Control Zone	Buffer Zone
Ground Strength	2	2
Ground Roughness	1	1
Slope	1	1
Merchantable Volume (m^3)/ha	147.0	184.4 (78.1)*
Unmerchantable Volume (m^3)/ha	38.6	22.7 (129.1)
Merchantable Stems/ha	1248	635 (111)
Unmerchantable Stems/ha	201	92 (616)
Merchantable Tree Volume (m^3)	0.12	0.29 (0.70)

*Brackets indicate values as per selective cut prescription.

time in the buffer zone as in the control area, as shown in Table 6. This is likely because of the high volume per log in the buffer and the fact that very little pulpwood was removed. Just the opposite occurred in the control zone where logs were not spaced as densely on the ground, and a higher proportion of pulpwood was forwarded. In both zones, the volume per load was significantly higher for logs than for pulpwood because the logs could hang past the end of the bunk. Furthermore, unloading the bunk took less time for logs than pulpwood. Hence the wood form and volume per piece both contributed to maintaining low loading and, in particular, unloading times for the buffer zone.

Eliminating the difference in travel distance between the two areas, as displayed in the adjusted figures in Table 6, indicates that the travel empty, but not the travel loaded elemental time, was affect-

Table 6. Production summary of Timberjack 230 Forwarder trail-cut - block number three.

Variable	Control Zone		Buffer Zone	
Timberjack 230 Forwarder				
Availability %	99.1	(99.1)	99.6	(99.5)
Utilization %	96.4	(96.3)	98.9	(98.8)
Productivity (m^3/pmh)	14.0	(14.2)	11.3	(12.5)
Volume (m^3)/cycle	7.8		6.9	
Loading Distance (m)	161		186	
Travel Empty + Travel Loaded Distance (m)	359	(320)	573	(320)
Logs: % Total Volume	78.4		87.7	
Volume (m^3)/log	0.20		0.22	
Production Cycle (Minutes)				
Travel Empty	2.28	(2.02)	4.55	(2.54)
Load and Manoeuvre	23.12		24.00	
Travel Loaded	2.38	(2.11)	3.82	(2.11)
Unload	3.55		36.70	
Total	35.77	(33.02)	4.33	(32.98)
Cutters	#1	#2	#1	#2
Availability %	91.7	92.0	95.7	100.0
Utilization %	82.0	71.8	82.9	100.0
Productivity (m^3/pmh)	2.7	2.8	3.4	1.9
Volume (m^3)/log	0.18	0.16	0.19	0.13
Logs: % Total Volume	59.9	65.2	88.2	52.2

ed by travel amongst standing trees in the buffer zone. This may have been due to the need to manoeuvre to within reach of a group of logs when travelling empty, as opposed to just following the most direct path out of the buffer zone when loaded.

The results of the production evaluation of the cutters (Table 6) illustrate the effect that stand variability can have on the volume they produce. In the control block, Cutter #2, faced with a smaller log size but a higher percentage of logs, managed to exceed the productivity of Cutter #1. However, the section of the buffer zone Cutter #2 was timed in had fewer logs overall, at a smaller average size than in the control zone. Cutter productivity will generally go down as the pulpwood content and hence pulpwood piling time goes up, and in this case caused a 33% drop in production. The 27% increase shown by Cutter #1 is more indicative of the expected results from this type of buffer zone treatment. Note that for this cutter, both the log content and size increased in the buffer relative to the control area.

Conventional cut and skid system

Block Number Four

This block was harvested using a Timberjack 240A Cable Skidder to skid full-trees to the landing. Both hardwood and softwood were harvested in the control area, but the selective cut prescription for the buffer zone dictated only softwood trees 30 cm outside bark and over at the stump and all dead softwood, were to be removed.

The control and experimental areas were a mature, fairly even-aged mixture of black spruce (Picea mariana (Mill.) B.S.P.), white pine, red maple, and white birch. Budworm damage was moderate in the control cut but severe in the buffer cut. An abundance of budworm-killed trees were present in the buffer zone, and density and stocking varied throughout resulting in a low merchantable volume compared to the control block. The amount of wood to be harvested in the buffer according to the selective cut prescription, shown in brackets in Table 7, was extremely low but the section of the buffer zone where the timing took place certainly had a higher volume. The stocking and density of this section were higher than the buffer zone average.

The stand and terrain conditions presented in Table 7 illustrate that the block and experimental areas did not pose many problems relating to general operability. Terrain factors were similar in both areas, and except that the ground was slightly uneven and had less than ideal strength characteristics, they were conducive to steady and high rates of production. The control zone and buffer zone were both flat.

Table 7. Stand and terrain conditions summary for block number four.

Site Factor	Control Zone	Buffer Zone
Ground Strength	2	2
Ground Roughness	2	2
Slope	1	1
Merchantable Volume (m^3)/ha	215.8 (118.9sw)	84.2 (37.8)*
Unmerchantable Volume (m^3)/ha	0.0	6.8 (53.2)
Merchantable Stems/ha	---	198 (49)
Unmerchantable Stems/ha	---	5 (154)
Merchantable Tree Volume (m^3)	---	0.42 (0.77)

*Brackets indicate values as per selective cut prescription.

The production of this crew in the experimental zone was a good example of the effect that tree size can have on cuts of this type. The summary in Table 8 confirms this since even a longer skid distance for the buffer zone did not prevent an increase in productivity. Although fewer trees were skidded per cycle and pmh, an average tree size almost double the control zone average yielded a higher volume per cycle. Notice also that these conditions shortened the decking time by over two minutes per cycle for the buffer zone.

The time elements of the skidder's production cycle were affected by differing amounts related mainly to stand factors in the buffer area. The adjusted travel times (in brackets) show that combined travel in the buffer and control zones was slower than just control block travel, probably due to the need to manoeuvre around standing trees. Positioning took marginally longer and choking time was lower, but choking time per tree increased since trees were larger and not felled as closely together as in the control cut. The spacing of trees

Table 8. Production summary of Timberjack 240A Skidder full-tree system - block number four.

Variable	Control Zone	Buffer Zone
Timberjack 240A Skidder		
Availability %	97.4 (97.0)	100.0 (100.0)
Utilization %	96.4 (96.0)	97.1 (96.5)
Productivity (m^3/pmh)	8.6 (9.7)	9.9 (12.1)
Volume (m^3)/cycle	2.9	3.4
Volume (m^3)/tree	0.14	0.28
Trees/cycle	20.2	12.1
Trees/pmh	59.6 (66.8)	35.8 (43.6)
Travel Empty + Travel Loaded Distance (m)	554 (300)	650 (300)
Production Cycle (minutes)		
Travel Empty	2.06 (1.12)	3.27 (1.50)
Positioning	0.85	0.89
Choking	7.75	7.54
Travel During Loading	0.18	0.79
Travel Loaded	2.71 (1.47)	3.48 (1.60)
Decking	6.68	4.35
Total	20.23 (18.05)	20.32 (16.67)
Cutter		
Availability %	93.1	91.8
Utilization %	53.4	44.2
Productivity (m^3/pmh)	17.8	20.2
Volume (m^3)/tree	0.18	0.29
Trees/pmh	98.6	70.4

on the ground also meant more travel during loading time was needed every cycle to avoid hauling out the mainline excessive distances.

The cutter's production increased in the selective cut also. Like the skidder, fewer trees were harvested per unit of time but despite this the productivity rose due to a higher average tree volume. The time spent assisting the skidder in the choking function was not considered a direct part of the cutter's productive cycle. This explains the low utilization factor and indicates he spent a larger percentage of his time assisting the skidder in the buffer than in the control zone.

Block Number Five

The second cut and skid operation used a Timberjack 208E Cable Skidder to skid tree-length softwood produced by two cutters. A fourth man was at the landing and bucked up each load of wood into pulpwood and logs. In the control zone all of the spruce, fir, and white pine were removed while only softwood trees 30 cm outside bark and over at the stump were taken from the 120 m wide buffer area.

The block was an uneven-aged mixed stand of spruce, balsam fir, white pine, eastern white cedar (*Thuja occidentalis* L.), sugar maple (*Acer saccharum* Marsh.), white birch, and aspen (*Betula* spp.). The density and stocking were variable but generally higher in the buffer zone where the merchantable volume, shown in Table 9, was also greater even when removing only the trees 30 cm and greater at the stump. The terrain conditions presented few problems except that though the dominating slope was class 1, a slope of class 3 approximately 60 m long occurred at the halfway distance of the block. The skidder always managed to climb this slope without spinning the tires, but was slowed down during the climb.

Table 9. Stand and terrain conditions summary for block number five.

Site Factor	Control Zone	Buffer Zone
Ground Strength	2	2
Ground Roughness	2	2
Slope	1	1
Merchantable Volume (m^3)/ha	96.0	128.5 (98.3)*
Unmerchantable Volume (m^3)/ha	18.8	38.4 (68.6)
Merchantable Stems/ha	329	288 (72)
Unmerchantable Stems/ha	129	120 (336)
Merchantable Tree Volume (m^3)	0.29	0.45 (1.36)

*Brackets indicate values as per selective cut prescription.

The information contained in Table 10 shows that the skidder's rate of production was affected in virtually the same way as the rate for block number four. The very high average tree size (white pine in particular) from the buffer zone managed to compensate for a one way skid distance of over 550 m, 219 m further than the control zone average, and give a higher productivity in the buffer zone. On an equal distance basis, productivity was considerably better in the buffer zone, especially due to the average volume per cycle. Each time element of the production cycle took longer in the selective cut due to

Table 10. Production summary of Timberjack 208E Skidder tree-length system - block number five.

Variable	Control Zone		Buffer Zone	
Timberjack 208E Skidder				
Availability %	97.5	(97.3)	98.9	(98.2)
Utilization %	80.8	(79.0)	92.77	(90.4)
Productivity (m^3/pmh)	8.6	(9.5)	8.6	(11.2)
Volume (m^3)/cycle	2.6		4.2	
Volume (m^3)/tree	0.35		0.90	
Trees/cycle	7.5		4.7	
Trees/pmh	24.6		9.6	
Travel Empty + Travel Loaded Distance (m)	696	(470)	1134	(470)
Production Cycle (Minutes)				
Travel Empty	2.74	(1.85)	4.71	(1.95)
Positioning	0.64		0.96	
Choking	4.66		5.29	
Travel During Loading	0.66		1.08	
Travel Loaded	3.12	(2.11)	6.78	(2.81)
Decking	6.45		10.41	
Total	18.27	(16.37)	29.23	(22.50)
Cutters	#1	#2	#1	#2
Availability %	93.2	96.0	94.5	97.7
Utilization %	56.0	57.4	37.5	51.4
Productivity (m^3/pmh)	6.8	9.2	10.8	8.2
Volume (m^3)/tree	0.30	0.54	1.18	0.93
Trees/pmh	22.5	17.1	9.2	8.9

larger tree size, standing trees, and spacing of the boles on the ground.

The long cycle time for the skidder when operating in the buffer zone gave the cutters close to an hour to prepare a twitch of wood. In some cases a load of two large pines was all that could be skidded and Cutter #1 cut most of these. Since they had such a high unit volume, he was able to increase his production rate considerably yet take longer breaks and decrease his utilization factor. Cutter #2 took more breaks but also cut fewer trees than Cutter #1 and these were smaller on average. The result was a modest decrease in productivity.

Block Number Six

A John Deere 440C Cable Skidder was used to selectively cut and then skid tree-length spruce and balsam fir 30 cm and over at the stump from the buffer zone on block six. The 85 m deep selective cut area was felled by two cutters as was the control block where only spruce and fir were harvested. Like block number five, a fourth man bucked the tree-length wood to pulpwood and logs at the landing.

The block was a dense, well-stocked, mature mixture of softwood and hardwood. Spruce, balsam fir, and eastern white cedar made up the softwood component, and budworm damage was moderate. Hardwoods accounted for 31% of the unmerchantable volume in the control area and 46% in the buffer zone, and included red maple, sugar maple, yellow birch (*Betula alleghaniensis* Britton), and black ash (*Fraxinus nigra* Marsh.). The information in Table 11 summarizes the stand conditions and shows that the major difference between the two areas was a higher volume per tree with a resulting increase in merchantable volume in the buffer zone.

Table 11. Stand and terrain conditions summary for block number six.

Site Factor	Control Zone	Buffer Zone
Ground Strength	2	2
Ground Roughness	2	2
Slope	2	1
Merchantable Volume (m^3)/ha	113.5	138.9 (45.6)*
Unmerchantable Volume (m^3)/ha	76.44	80.5 (173.8)
Merchantable Stems/ha	716	711 (62)
Unmerchantable Stems/ha	235	184 (833)
Merchantable Tree Volume (m^3)	0.16	0.20 (0.74)

*Brackets indicate values as per selective cut prescription.

The terrain conditions outlined in Table 11 were not ideal but also did not present major interruptions in the production cycle. Ground roughness affected skidder travel more in the buffer zone, since standing trees had to be avoided and the operator tried to stay on skid trails, and could not avoid obstacles as easily as in the control block.

The harvesting crew for this block provide an example of how inexperience and low utilization can hamper operations during a selective cut situation, as illustrated in Table 12. In the control and buffer areas, because the cutters took long and frequent breaks, the skidder was often forced to wait for trees to be limbed and this lowered the machine's utilization. The skidder operator was new to the job, did not drive the machine to its capability, and took considerable time steering around obstacles and trees. The net result was poor productivity in the control area of about half of what an experienced crew could have attained. The extra distance and need to manoeuvre around standing trees in the buffer strip lowered productivity even further, though tree size was appreciably larger. On an equal distance basis, the two travel times (i.e. empty and loaded) increased 37% for the

Table 12. Production summary of John Deere 440C Skidder tree-length system - block number six.

Variable	Control Zone		Buffer Zone	
Timberjack 440C Skidder				
Availability %	98.4	(98.2)	98.4	(98.2)
Utilization %	77.6	(75.3)	68.0	(65.2)
Productivity (m^3/pmh)	4.4	(5.0)	4.0	(4.5)
Volume (m^3)/cycle	2.1		3.4	
Volume (m^3)/tree	0.20		0.37	
Trees/cycle	10.5		9.3	
Trees/pmh	21.8	(24.7)	10.7	(12.2)
Travel Empty + Travel Loaded Distance (m)	704	(400)	836	(400)
Production Cycle (Minutes)				
Travel Empty	4.15	(2.36)	5.32	(2.77)
Positioning	1.31		1.88	
Choking	8.56		12.11	
Travel During Loading	0.99		1.78	
Travel Loaded	3.79	(2.15)	6.55	(3.42)
Decking	10.14		19.67	
Total	28.94	(25.51)	47.31	(41.63)
Cutter				
Availability %	93.6		96.1	
Utilization %	56.5		48.5	
Productivity (m^3/pmh)	3.3		4.2	
Volume (m^3)/tree	0.21		0.41	
Trees/pmh	15.6		10.3	

combined buffer-control zone travel compared to just the control, and all other elements of the production cycle increased by varying amounts.

The cutter had a low utilization in both areas. Part of the reason was because of time spent helping the skidder load but frequent breaks also affected utilization. Tree size almost doubled in the selective cut which lead to higher productivity, but the cutter did not benefit appreciably in terms of wood produced for every hour spent on the job.

Block Number Seven

The last cut and skid evaluation was a tree-length operation where all of the spruce, fir, jack pine (*Pinus banksiana* Lamb.), and log-quality white pine were harvested from the control area. The buffer zone was 60 m wide and 30 m of this was selectively cut. All spruce, balsam fir, and jack pine 25 cm and over outside bark at the stump and white pine 36 cm and over outside bark at the stump were removed.

The block was a mature mixture of softwoods with hardwoods accounting for only a small percentage of total volume. The spruce-fir component made up 33% of the softwood volume in the control zone and 18% in the buffer zone, and damage due to budworm varied from moderate to severe. Table 13 illustrates that the volume in the buffer zone was

Table 13. Stand and terrain conditions summary for block number seven.

Site Factor	Control Zone	Buffer Zone
Ground Strength	2	1
Ground Roughness	2	2
Slope	1	1
Merchantable Volume (m^3)/ha	113.8	205.8 (110.1)
Unmerchantable Volume (m^3)/ha	21.6	31.8 (127.5)
Merchantable Stems/ha	430	583 (138)
Unmerchantable Stems/ha	133	151 (596)
Merchantable Tree Size (m^3)	0.26	0.35 (0.80)

*Brackets indicate values as per selective cut prescription.

considerably higher than in the control cut, but approximately the same in view of the selective cut prescription. Tree size was also larger in the buffer zone and stocking was good.

The terrain conditions were similar for the two areas, but as shown in Table 13, the ground strength was superior in the buffer zone mainly because of better drainage into the adjacent stream. However the lower ground strength in the control zone did not affect skidder movement appreciably. The other terrain factors were the same in both zones and were favourable for skidding.

The crew was not able to produce at as high a rate in the selective cut as in the control cut. The production variables presented in Table 14 are evidence once again of how a lack of experience can interrupt a harvesting operation. The skidder operator was adept at manoeuvring in the buffer area and was not at fault for his lower productivity. The problem centred around the inability of one cutter to directionally fell his trees. Although a count was not made, he was estimated to have hung up half of the trees he cut and did not attempt to fell them in one direction to facilitate skidding. The skidder often had to choke the trees and pull them down and then wait for them to be limbed, and this lowered the utilization considerably. Furthermore, rather than waiting for a full load, the operator often took just what was ready; this reduced the average volume per cycle. Only a larger tree size prevented a more substantial drop in net production.

Like other skidder operations, elemental times were affected by conditions within the buffer cut. Choking time per tree and positioning time per load rose, although due to adept manoeuvring, the travel during loading element decreased. On an equal distance basis, travelling empty into the cut took less time but the skidder was able to use a section of haul road for this and thus saved time; travel loaded increased due to manoeuvring within the cut.

The information gathered for the cutter is self explanatory. Hanging up trees decreased his utilization, but an increase in tree volume of over two times increased his net production marginally.

Table 14. Production summary of Clark 664 Ranger Skidder tree-length system - block number seven.

Variable	Control Zone		Buffer Zone	
Timberjack 440C Skidder				
Availability %	98.5	(98.4)	95.0	(94.9)
Utilization %	90.0	(89.5)	77.7	(77.3)
Productivity (m^3/pmh)	6.9	(7.3)	6.2	(6.3)
Volume (m^3)/cycle	2.4		1.9	
Volume (m^3)/tree	0.17		0.28	
Trees/cycle	13.9		6.7	
Trees/pmh	40.1	(24.7)	22.1	
Travel Empty + Travel Loaded Distance (m)	430	(310)	350	(310)
Production Cycle (Minutes)				
Travel Empty	2.41	(1.74)	1.65	(1.46)
Positioning	0.47		1.27	
Choking	9.22		8.89	
Travel During Loading	0.91		0.40	
Travel Loaded	2.15	(1.55)	2.16	(1.91)
Decking	5.56		3.77	
Total	20.72	(19.45)	18.14	(17.70)
Cutter				
Availability %	89.9		89.0	
Utilization %	76.9		63.1	
Productivity (m^3/pmh)	4.2		4.6	
Volume (m^3)/tree	0.17		0.38	
Trees/pmh	25.2		12.3	

Small-Scale System

Block Number Eight

An evaluation was made of a selective cut carried out in a deer wintering area and/or travel corridor that was adjacent to a stream buffer zone. Although the stand did not form part of the buffer zone and control data was not available, the operation was of interest because the cutting took place on a site typical of many stream buffers in the Restigouche-Tobique License. Furthermore, it presented an opportunity to evaluate a system of small-scale harvesting equipment to determine its suitability for this type of operation. The cutting prescription called for the removal of the oldest and least healthy trees in the stand, however a small percentage of healthy trees were cut as well. Spruce and fir were the predominate species of the stand and ranged from mature and even-aged in some areas to a more uneven-aged condition in other sections. Cruise information was not available, however the merchantable volume was estimated to have been 150 to 180 m^3/ha, and stocking was variable but generally good.

The operability of the cut block was most affected by slope. Some sections were relatively flat, but the major portion of the block had slopes ranging from 10 to 40 %. The ground roughness and strength were both good throughout the area.

Skid trails were spaced at approximately 100 m intervals, down and slightly across the slope. Operating from these trails were small pieces of equipment which included a Radio-TIR 1200 Logging Winch, a Belarus 420 Farm Tractor equipped with a Farmi Logging Winch, and a small, tracked Bombardier ATV with a rear-mounted winch. Each equipment type worked with a cutter to cut and then forward wood tree-length to a trail. They attempted to work on the trails where practical to minimize site damage. A Timberjack 209D Cable Skidder removed the wood from the trails, skidding to a landing at the top of the slope for bucking.

Each machine was evaluated at a number of locations within the stand. The results presented in Table 15 show that the system was well matched, in that the skidder was able to keep up with the total production from the other machines. The utilization and availability factors for the machines varied considerably due to two reasons.

Table 15. Production summary of small-scale tree-length system - block number eight.

Variable	Skidder	Farmi Winch	Radio-TIR Winch	Bombardier
Availability (%)	97.9	95.5	84.6	57.1
Utilization (%)	71.2	50.1	53.8	33.4
Productivity (m^3/pmh)	5.3	1.6	2.8	3.3
Productive Time (%)				
Travel Empty and Positioning	15.8	28.0	15.1	19.8
Choking and Winching	20.9	69.8	73.6	54.8
Travel Loaded	19.1	1.2	--	15.9
Decking	44.2	1.0	11.3	9.5
Scheduled time (%)				
Productive	71.2	50.1	53.8	33.4
Mechanical Delays	2.1	44.4	30.8	42.9
Non-mechanical Delays	26.7	45.5	15.4	23.7

Mechanical failures plagued the Radio-TIR Winch and the Bombardier, and often took a disproportionate time to repair due to lack of maintenance support on the site, and the operator's unfamiliarity with the machines. Utilization was also lowered because the workers took breaks whenever enough wood was piled down for the next load. This situation arose because payment was not dependent on the volume produced.

The performance of each machine in relation to site conditions was also quite variable. The skidder had little difficulty working in the stand but was slowed down when climbing 40% slopes with a full load. The Belarus tractor with the Farmi winch had problems manoeuvring and setting up on slopes greater than 10-15% because of the inherent instability of the machine on slopes. The Radio-TIR logging winch encountered no difficulty with site conditions since it is stationary when forwarding wood, and the operator did not slow down as conditions changed. This winch was the most immune to production changes relating to site variability. The Bombardier operated effectively when the load was small and the slope was 10% or less. As both of these grew, this machine became quite unstable because the front end was light since the engine was rear-mounted. The operator often skidded wood with the Bombardier tilted upwards at 45 degrees, with the front of the tracks off the ground. This problem, coupled with a difficulty overcoming obstacles, resulted in the machine flipping over twice during the evaluation period.

As a system, and disregarding low utilization problems, the machines worked well together. The Bombardier and the Farmi tractor-mounted winch performed best on the flatter terrain, while the Radio-TIR winch was much more adaptable. Individual production rates were hindered by the quality and size of the trees removed. Most trees were dead or dying, which caused frequent breakage during forwarding. Productivity would have improved had a greater number of healthy, sawlog-size trees been harvested, but restrictions relating to wildlife use of the stand precluded this opportunity.

COST ANALYSIS

The comparison of different harvesting operations based on costs rather than productivity is more meaningful to operations personnel. A theoretical cost analysis of the experimental buffer zone cuts and their respective control cuts has been done to facilitate this comparison. It is theoretical because Licensees and contractors were not asked to supply cost estimates. Instead, machine rental rates are based on average operating and fixed costs during the life of the machine. These costs are derived from input variables which are listed in Table 16. Some of these, such as machine life, are estimates of long-term averages, while others, such as brake-horsepower, are known factors. Purchase prices are all quoted in 1983 dollars. The machine rental rates per pmh are shown in Table 17 along with a summary of the input costs.

During the study, harvesting operations were evaluated only from stump to roadside. Since wood form varied from full-tree to shortwood, all costs are quoted for slashed wood at roadside. For tree-length and full-tree systems, a slashing cost of $\$2.57/m^3$ has been assumed. Delimbing costs, based on a rental rate for a Denis delimber (Table 17), are estimated at $\$2.50/m^3$ (20 m^3/pmh). Harvesting-related costs such as scaling, supervision, camps, and others are not included.

To reflect the production changes due to site conditions in the buffer zone, the wood cost for the machines is derived from the actual buffer zone productivity. The machine cost component from the control zone is not based on the productivity as derived directly from the time studies. Instead, this cost is determined from the rate of production obtained from machine cycle distances equal to half the depth of the control block. This assumes that the machine component of the wood cost occurs at the average travel distance for the control block.

Cutters are usually paid on a volume basis and control costs of \$7.50, \$4.93, and \$2.43 per m^3 have been assigned to trail-cut, tree-

Table 16. Variables description for machine rental rates.

Variable	KFF	TJ 230 Forwarder	TJ 240A Skidder	TJ 208E Skidder	Clark 664 Ranger Skidder	JD 440C Skidder	Denis Delimber, Drott 40 Carriage
Total Purchase Cost ($)	400,000	98,400	86,300	53,300	70,670	71,778	160,000
Residual Value ($)	75,000	10,000	9,000	5,000	7,000	7,000	16,000
Machine Life (amh)	20 000	15 000	15 000	15 000	15 000	15 000	20 000
Scheduled Hours Per Shift	10.0	8.0	8.0	8.0	8.0	8.0	10.0
Shifts Per Day	2	1	1	1	1	1	2
Operating Days Per Year	230	200	200	200	200	200	230
Average Utilization	0.80	0.80	0.80	0.80	0.80	0.80	0.75
Interest Rate (%)	13.0	13.0	13.0	13.0	13.0	13.0	13.0
Insurance (% of Average Investment)	2.0	2.0	2.0	2.0	2.0	2.0	2.0
License ($/Year)	0	0	0	0	0	0	0
Service and Repair Cost (% of Unit Cost)	150	125	100	100	100	100	125
Net Brake Horsepower	255	84	112	65	84	80	127
Workload Factor	0.80	0.80	0.80	0.80	0.80	0.70	0.80
Fuel Type (Gas or Diesel)	D	D	D	D	D	D	D
Fuel Cost (untaxed, $/litre)	0.396	0.396	0.396	0.396	0.396	0.396	0.396
Hydraulic Oil and Lube Use Category	C	A	A	A	A	A	B

A) Skidders

B) Slashers

C) Harvesters

Table 17. Machine rental rates cost summary.

Variable	KFF	TJ 230 Forwarder	TJ 240A Skidder	TJ 208E Skidder	Clark 664 Ranger Skidder	JD 440C Skidder	Denis Delimber, Drott 40 Carriage
Useful Life (years)	5.43	11.72	11.72	11.72	11.72	11.72	5.80
Capital Recovery							
Depreciation/Year ($)	96,804	16,397	14,371	8,899	11,783	11,973	38,958
Variable Costs $/pmh							
Repair Cost	30.00	8.20	5.75	3.55	4.71	4.79	10.00
Fuel Cost	17.77	5.85	7.81	4.53	5.85	4.88	8.85
Lube Cost	3.19	0.42	0.56	0.33	0.42	0.35	0.95
Fixed Costs $/pmh							
Cap. Recovery Depreciation	26.31	12.81	11.23	6.95	9.21	9.35	11.29
Insurance	1.45	0.91	0.80	0.49	0.65	0.66	0.58
Operator Cost $/pmh							
Wages	13.33	12.50	12.50	12.50	12.50	12.50	13.33
Incentives and Fringe							
Benefits	3.87	1.88	1.88	1.88	1.88	1.88	3.87
Machine Rental Rate							
($/pmh)	95.92	42.57	40.53	30.23	35.22	34.40	48.87

length, and full-tree operations respectively. Where buffer zone productivity rose, the rate remains the same and the cutter gains in wages per hour, but for cases where productivity dropped, the cost per m^3 has been raised to maintain the earnings per hour established in the control area. This approach is based on the premise that a cutter would not work in a buffer zone at a lower earning rate than in a regular cutting operation.

Final wood costs are listed in Table 18 for blocks one through seven; block eight is described separately. The costs are not intended to reflect the actual costs incurred by Licensees, but rather are estimates of the cost of specific machines at the rental and production rates that have been described. The significance of these costs is the difference between control and buffer zone costs, which range from -1.0% to +12.1%. These differences indicate that among the various harvesting systems evaluated during this study, the average cost increase for buffer zone wood was only 5.6%.

Table 18. Wood costs summary ($/$m^3$).

Block	Control Zone Cost	Buffer Zone Cost	% Change in Buffer (+ Increase)
1 - mechanical, full-tree	$ 8.91	$ 8.98	+ 0.8
2 - trailcut, shortwood	10.06	10.75	+ 6.9
3 - trailcut, shortwood	10.40	11.46	+ 10.2
4 - conventional, full-tree	11.65	11.53	- 1.0
5 - conventional, tree-length	10.57	10.89	+ 3.0
6 - conventional, tree-length	14.31	16.04	+ 12.1
7 - conventional, tree-length	12.21	13.10	+ 7.3

Table 19 is a summary, based on scale, of the size of wood extracted from these areas, and illustrates that in the majority of cases larger trees were harvested. Based on observations in the field, wood quality also tended to improve in the buffer zones. These findings, and the results of the theoretical cost analysis, suggest that buffer zone harvesting operations are potentially economical.

Table 19. Wood size summary (m^3).

Block Zone	Wood Form	Control Zone	Buffer Zone
1	stem	0.12	0.19
2	bolt	0.02	0.02
3	log	0.20	0.22
4	stem	0.14	0.28
5	stem	0.35	0.90
6	stem	0.20	0.37
7	stem	0.17	0.28

The small-scale system costs, shown in Table 20, are based on fixed hourly rates for men and machines and thus this selection cut, on a cost basis, cannot be evaluated fairly. The fixed hourly rates for the Bombardier and Belarus tractor-winch are high in view of their capital costs and utilization, and no incentive existed to encourage higher production. Harvesting costs would drop substantially if these two problems were resolved.

Table 20. Small-scale system costs.

Variable	Cost$/amh	amh/week	Cost$/week
Cutters, Machine Operators (9)	--	--	2961
Bombardier	15	32	480
Belarus Tractor, Farmi Winch	15	38	570
Radio-TIR Winch	7	34	238
Timberjack 2090 Skidder	20	39.5	790
Chainsaws	--	--	60
			$5,099
Total Cost/Week			$5,099
Production/Week			141.2 m^3
Cost/m^3			$36.11

SUMMARY

In view of the changes in production and cost rates between control and buffer zone harvesting operations, this study has shown that partial cuts in buffer zones can be cost competitive. The effect that buffer zone wood costs would have on overall wood costs at roadside, on a particular operation, would be minimal.

A number of factors have been shown to affect productivity in the buffer zones. The extra travel distance, and in selective cuts the need to manoeuvre around standing trees, raised the productive cycle times slightly in most cases. However, an increased average tree size and better quality wood virtually negated the influence that increased cycle times had on net productivity. Experience and skill have been shown to also be factors affecting the success of buffer zone operations. Particularly when selectively removing trees, only cutters and machine operators with the skill to cut and remove wood quickly and efficiently should be employed.

Buffer strips characterized by extreme stand and terrain conditions were not evaluated during this project. If ground roughness, ground strength, or slope deviate significantly from those present in an adjacent clearcut block, then the production for the two areas is going to differ to an unknown degree. This difference will, like the experimental areas studied, be governed by the site and quality of wood harvested and any extra travel distance required.

PART III

RECOMMENDATIONS

GARY MOORE

RECOMMENDATIONS

The interim guidelines included in the literature review (which was printed in April, 1983) were largely derived from the material therein. Based on the results of the field work and input from field personnel these guidelines have now been modified in an attempt to more practically conform to current conditions in New Brunswick. An attempt was made to ensure an unbiased attitude in discussing the various facets of buffer zone management.

This "modification" has not produced a more definitive set of guidelines regarding the preferred width of buffer zones or the type and amount of wood removal which can occur in these zones. The most commonly recognized value of buffer zones is the protection of water quality; information and formulae regarding the effects of disturbance and increased exposure is abundant. However, the current field work has illustrated the value of these zones to the wildlife and aesthetic resources and these must become an active consideration by both D.N.R. and Licensee personnel. If buffer zones are to be properly managed on a multiple use basis, an individual decision regarding each zone is necessary. This will necessitate considerably more emphasis on the non-wood fiber resources than has taken place in the past.

(1) The decision-making process regarding the establishment of buffer zone widths should be more uniform between Forest Regions. However, this does not imply that average widths should be similar between Regions, due to variations in such things as climate, condition of wood in buffer zones, demand for wood, topography and desired species. All watercourses associated with scheduled cut blocks should be examined in the field by biological and forestry staff to evaluate the value of the buffer zone to the fisheries, wildlife and aesthetic resources, as well as the condition of the zone itself. Any additional tributaries or springs deemed to require protection, or discrepancies in the Operating Plan or mapping procedure, can be identified at this time. From this inspection a decision regarding zone width and any subsequent timber harvesting within this zone can be made. The important point is that an individual decision regarding the management of each buffer zone is necessary and this decision must be based on a field inspection; this will obviously entail an increase in the number of D.N.R. staff days currently devoted to buffer zone management.

(2) The current recommendations for buffer zone widths of 15, 30 and 60 m on slopes of 0-5%, 5-10% and greater than 10%, respectively, appear in practice to be satisfactory if the only concern is for maintenance of water quality. Provision for wildlife and aesthetics will normally necessitate widening of the zone, dependent on current and future surrounding land usage. As a general rule, the greater the amount of current or projected timber removal from the surrounding land, the wider the buffer zone which should be left to accommodate wildlife concerns. The long-term effects of buffer zone establishment and management on the wildlife and aesthetic resources are harder to define than the effects on the fishery resource and have been largely neglected; they are, nevertheless, very important and must be given consideration.

(3) The criteria specifying that all streams 0.5 m or greater in width require a buffer zone should be reinstated to serve as a general baseline in the event that a stream is not detected by D.N.R. staff before or during a cutting operation. The Regional Biologist(s) must have flexibility in deciding whether a particular stream under 0.5 m in

width requires a buffer zone or if the above-mentioned criteria should be waived in certain cases. All buffer zone widths must be measured from the normal high-water mark (often delineated by the termination of alders). This is obviously tempered by local variation in flooding conditions, as well as the location and extent of flood plains. It should be noted that, under Regulations of the Clean Environment Act and the "Harvesting and Utilization Requirements" in the 1984 Forest Management Manual For Crown Lands, no wheeled or tracked harvesting equipment is permitted to operate within 10 m of the edge of any watercourse, regardless of width.

(4) Most forms of specialized harvesting within buffer zones can be carried out in an economical manner. Determination of such harvesting must be made in light of fishery, wildlife and aesthetic concerns. The effect of any alteration on the residual vegetation (e.g. potential for blowdown) must also be considered, as must the demand for the wood within the zone and its current condition.

(5) Operators must be given adequate time for examination of any proposed buffer zone cutting plans to allow for alteration of the road or skidtrail network. These plans should be flexible in the event that changes are desired by operators but there should be no compromise at the expense of the fishery, wildlife or aesthetic resources. For economic reasons harvesting within buffer zones should normally take place at the same time and with the same equipment as in the cut block although, under certain circumstances, specialized equipment and/or crews may be advisable. No subsidies should be paid for this specialized harvesting; any extra costs associated with extra care and planning of the operation or use of specialized equipment or techniques, if existent, should be evaluated in light of the fact that wood harvested from buffer zones will normally represent only a small portion of any annual harvest. If subsidies were paid there would likely be a bias in that operators would only want to harvest wood from wide buffer zones. Relatively narrow buffer zones (15 m) do not provide much opportunity for clearcutting patches or strips although selective cutting is still feasible.

(6) Selective cutting will generally result in a less extreme modification of the buffer zone and may be more aesthetically pleasing. The "patchiness" created by some selective cuts may be very beneficial to wildlife. Although it may be more expensive than some form of clear-cutting, due to the greater emphasis on directional felling (cutter experience is important) and a greater number of roads and skidtrails per volume of wood removed, this may be offset by the value of the largely sawlog material obtained. Normally there is some degree of high-grading associated with a diameter limit selective cut as only the larger, supposedly genetically superior, trees are removed. Some damage to the residual vegetation during felling and skidding is also generally unavoidable.

In diameter limit selective harvesting operations the location of the diameter measurement should be specified to avoid overcutting due to butt swelling. If individual tree marking is deemed to be necessary, trees to be cut should be sprayed with paint from the ground to a point above the location where the felling cut will be placed. This ensures that both the stump and bole are marked and facilitates identification of violations.

(7) Adequate supervision is needed for any such specialized harvesting operation. The establishment of an exclusion zone (no harvesting allowed) immediately adjacent to the watercourse will normally provide protection from increases in water temperature and sedimentation. Sediment flow through the exclusion zone is possible on relatively steep slopes but such slopes are considered inoperable in many parts of the province. Measures designed to minimize sedimentation must be strictly adhered to. Soil disturbance and compaction must be minimized; this entails utilization of the proper equipment, as well as proper planning and care during the logging operation. Harvesting in high erosion risk areas should either be prevented or timed after soil freeze-up. The latter alternative will necessitate considerable advance planning but the current timing of cut block operations by Licensees is, for the most part, not well refined.

(8) As previously mentioned, wider zones than those advocated for water quality protection will normally be necessary for wildlife management goals. Wider buffer zones provide more opportunity for specialized harvesting. The normal result of this harvesting, whether it involves patch or strip cutting or some form of selective harvesting, will be the creation of "edge" effect and browse material. It therefore may be advisable to enlarge the zone width and allow wood removal within it. For species requiring undisturbed forest or travel corridors the best management will consist of leaving the zone intact particularly if the surrounding area has been, or is anticipated to be, heavily disturbed. Buffer zones should normally be interconnected, not isolated patches of standing timber interspersed among the clearcut areas. Thus, the strategy adopted should be a function of the level and type of wildlife management desired for a particular site.

Enlargement of buffer zone width must be made in consideration of predicted or anticipated residual tree mortality. However, this should not become a commonplace excuse for not enlarging the zone width. As long as mortality is localized (which is normally the case) and is not uniform throughout the zone then enlargement will still be beneficial to wildlife.

(9) Licensee and D.N.R. personnel must explain the various environmental concerns to operators as well as the reasoning behind any particular buffer zone cutting plan. It is hoped that, over the long-term, Licensees and operators will provide the impetus for specialized wood harvesting in buffer zones. In spite of opportunities to obtain normally unavailable wood volumes, there was a general unwillingness among Licensees to carry out specialized harvesting. Where specialized harvesting in a buffer zone is deemed by D.N.R. personnel to be desirable in terms of not harming, and possibly enhancing the benefits provided by the zone, then permission to harvest the normal cut block should be contingent upon agreement by the Licensee to conduct the specialized harvesting.